COMPARISONS OF TELECOMMUNICATIONS MARKETS IN REGULATED AND DEREGULATED MARKET ENVIRONMENTS

CASE STUDY OF CELLULAR PHONE MARKETS IN CHINA AND HONG KONG

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ABSTRACT

This project analyses the telecommunication markets in a regulated and deregulated market environments through a case study of cellular phone markets in PR China and Hong Kong. We first discuss how the macroenvironmental factors such as economic background, basic telecommunication infrastructure, basic cellular environment and characteristics of cellular market which affect the business operations. The economic environment affects consumer purchasing power and spending pattern while the government has specific policies for telecommunications especially the regulation and deregulation of competition. Telecommunication is a major sector for industrialization process and it greatly influences the investment climate and country's productivity.

We further discuss the development trend of cellular communications and the cellular terminal markets in both PR China and Hong Kong in terms of market size, subscriber distribution, subscriber growth and the various factors that create the black market business. Equally important is the customer preference, customer trends and subscriber charge of cellular operations. All these will affect the total demand of cellular communications in a country.

Technology breakthrough is a vital process in cost minimization and we will highlight the migration of analogue cellular operations to various digital standards. Above outlines will give a brief understanding and comparison of telecommunication markets in a regulated and deregulated environment through analysis of PR China and Hong Kong in individual subject. We finally summarize the project by recommending for a new entrant into the markets. This recommendation will include all factors we analyzed in previous chapters.

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CHAPTER I

INTRODUCTION

This project analyses the telecommunication markets in a regulated and deregulated market environments through a case study of cellular phone markets in PRC and Hong Kong.

Economic Background

The economic environment consists of factors that affect consumer purchasing power and spending patterns. Markets require purchasing power as well as people. Total purchasing power depends on current income, prices, savings and credits.

PRC

China, covering 9.56 million square kilometres, is the world's second largest country in area and has the world's largest population of 1.2 billion people. During most of the 1980s China began to experience considerable economic progress as industrial and agricultural output grew following liberalisation of Government economic policies which succeeded in attracting high levels of foreign investment.

Between 1980 to 1991 the Chinese economy grew at an annual average rate of 9.4%. Estimate of per capita income of US$2,600 a year would make the Chinese economy the world's second largest though some economists argue that real per capita income is less than half this figure.

China's economic boom has been stimulated by the government's open door policy creating a growing level of foreign investment and a strong increase in exports. China's share of total world exports grew from 0.9% in 1980 to 2.3% in 1992. In 1973 China was the world's 20th largest exporter; by 1985 it was 15th, and by 1992 it was 11th.

In the late 1980s China faced difficulties with younger people in some areas becoming dissatisfied at slow social progress. Economic growth slowed following an overheating of the economy which the government tried to remedy by tightening expenditure controls. Foreign investment slumped following the 1989 Tiananmen Square massacre in Beijing and remained at a low level for the next two years while China's relations with western countries gradually began to improve once again.

Since 1991, foreign investment in China has began to surge once again with introduction of the Government's open policy aimed at encouraging foreign investment. While there is talk of Chinese economy being overheated again, the opportunities offered by this large country and its huge population have caught the imagination of international business community. Foreign investment is expected to grow in future further stimulating economic development throughout China as the

Government's open door policy opens new areas of the economy to foreign participation.

In 1993 direct foreign investment in China totalled US$26 billion, more than five times the US$5 billion of foreign investment that flowed into the country in 1991. In 1993 more than one quarter of China's exports were from foreign invested companies which accounted for 70% of all export growth in 1993.

China's strong economic growth has been most evident in the eastern coastal provinces and south China. This trend is expected to continue with these provinces likely to witness strongest growing demand for telecommunications services of all types including cellular mobile phones which are now appreciated as a useful business tool while still being considered an important status symbol.

Hong Kong

The Hong Kong economy maintained a steady growth in 1993. The gross GDP grew by 5.5% in real terms with increase of 5.4% in the first half of the year and 5.6% in the second half. The corresponding growth rate in 1992 was 5.3%.

Economy policy in Hong Kong is to a large extent dictated, and constrained, by the special circumstances of the economy. Owing to its small size and open nature, the economy is vulnerable to external factors, and Government actions designed to offset unfavourable external influences are of limited effectiveness. The Government tries

not to interfere the private sector and let the market forces to allocate the resources in the economy.

This basically free enterprise, market disciplined system has continued to contribute to Hong Kong's economic success. A relative simple tax structure, with low tax rates, provides a good incentive for workers to work and for entrepreneurs to invest. Both workers and entrepreneurs are highly motivated. The prime role of the Government is to provide the necessary infrastructure and a sound legal and administrative framework conductive to economic growth and prosperity.

Basic Telecommunications Structure

The government develops specific policies for telecommunication and support them with investment. Accordingly, the government will also have an economic policy and this will have a significant influence upon the regulation of competition, upon permissible business practices, upon standards and so on.

PRC

The public telecommunications network is used to be monopolised by the Ministry of Post and Telecommunications (MPT). However, during the 1990s, telecommunications is one of the sectors targeted by the government for priority development to help speed up China's industrialisation process, as part of efforts to hasten telecommunications development the government has approved the formation of two new state enterprises - China United Telecommunications Corporation (China

Unicom), also known as Lian Tong, and Ji Tong - both established to offer communications services in addition to MPT in future.

China Unicom was formally established in July 1994 to construct and run second operator networks for various fixed line and mobile services including a national GSM network.

Currently some 26 million telephone lines are installed around the country in public exchanges and more than six million other lines in private exchanges. After installing 12.8 million telephone exchange lines in 1993 MPT expects to have invested about US$6.2 billion installing another 12 million exchange lines nationally in 1994.

MPT plans call for some 60 million new lines to have been installed at the end of the current Ninth Five Year Plan which ends in the year 2000. By the year 2000 China is planning to have some 80 million exchange lines in service plus the benefits of a modern high capacity national trunk transmission network. China Unicom is expected to be an important service provider by then.

At present China has a telephone line density of less than 1% of its huge population. Efforts are underway to expand local, long distance and international services though demand for telephones still is rising well ahead the country's ability to expand its services. The government's eventual target is to achieve a telephone density of 40 lines per 100 people, the same as most newly industrialised countries in Asia. To

reach this target China will need to have about 500 million exchange lines in service, a situation that still is a very long way off.

Until 1933 telecommunications was organised under two government ministries. Recently after 18 months of intense lobbying China Unicom and Ji Tong were given approval to run telecommunications services while China Electronic Equipment System Engineering Company (CESEC), the People's Liberation Army (PLA) - controlled telecommunications services agency, also is planning to set up various mobile and value added services for internal use and later offer these to the public.

China Unicom was set up by the powerful reform-minded Ministry of Electronic Industries, the Ministry of Railways, the Ministry of Electric Power, China International Trust and Investment Corporation (CITIC) which is Beijing's leading international investment house, plus about 12 large state-run corporations to establish and operate mobile cellular services, paging systems, a long distance telephone network, international gateway facilities, value added and other services.

China Unicom is also referred to simply as Unicom. The term China Unicom distinguishes the enterprise as a whole from its regional units such as Beijing Unicom, Shanghai Unicom, Guangzhou Unicom and other branches.

Formally established on July 19, 1994, Unicom is still drawing up its corporate development programme which is expected to be announced before the end of 1994.

Among targets already revealed is a plan to serve 30% of China's mobile telephone market by the year 2000 and to handle 10% of all China's long distance calls by that time.

Ji Tong is owned by about 30 state-owned enterprises and research institutes, most of which are allied with the Ministry of Electronic Industries (MEI) and CITIC.

Ji Tong is a high-tech manufacturing and applications enterprises responsible for developing information and telecommunications technology. Already Ji Tong is committed to develop the overall design for several major information and communications projects described as the "Golden Projects" which include a national credit card system, a national processing system for the Customs Department and a national data information network.

Meanwhile, CESEC is also looking to develop mobile telephony services as part of attempts to make the defence services financially self sufficient. CESEC, which controls the AMPS-A band, has adopted a different approach to China Unicom and has been looking to co-operate with MPT in developing its services, for example, by including the local city PTA in any project to install a cellular system.

Currently CESEC is studying offers from China Unicom and MPT to co-operate in developing AMPS-A band cellular services. A decision is awaited.

Until now MPT, which oversees about 2,000 provincial, city and country PTAs, has been responsible for providing China's domestic and international communications services. On a provincial and local level the number of PTAs involved creates inevitable problems in planning and implementing expansion schemes through the large bureaucratic process involved.

Hong Kong

Hong Kong has a very high telephone densities with around 3.8 million telephones representing a 65% density. The Hong Kong Telecom Limited currently operates the wireline PSTN under an exclusive franchise which expires on June 30, 1995. External communications continue to be provided by Hong Kong Telecomm International Limited (formerly Cable & Wireless) under an exclusive franchise confirmed in place until September 30, 2006. The Government has awarded contracts to Hutchison Communications, New T & T Hong Kong, and New World Telephone and from 1995 onwards, the Government will open the Fixed Telecommunication Network Services (FTNS).

Basic Cellular Environment

From 1986 to 1991, world-wide cellular subscriber demand grew from 1.3 million to 16.2 million. By the end of 1993, it had more than double to 34 million. By 1993, 117 countries had at least one cellular system on line and by 1995, 130 countries are expected to have cellular systems. Total world-wide cellular penetration of countries with cellular service was under 0.1% in 1987 and is expected to increase to

2.3% in 1999. In terms of cellular subscribers by system type, in 1993, the majority (62%) were on AMPS systems, mainly in the US, Latin America, and Asia Pacific. By 1999, analyst projects that 39% of the world's cellular subscribers will be using digital systems, largely at the expenses of analogue counterparts. An estimation 60% of those will be using GSM (European developed standard), mainly in Western Europe and Asia. DAMPS subscribers (13%) will come mainly from North America and Asia while CDMA subscribers (3%) are expected to come from the US and Asia.

While the Asia Pacific countries have 60% of the world's population, the region contains less than 17% of the world's telephones. Terrain in developing regions complicate access to basic infrastructure services for rural residents. Consequently, 80% of all telephone lines serve urban subscribes. The high cost of constructing landline service for basic infrastructure in rural areas produces a small return on invested capital. Thus, countries with undeveloped areas, such as China, the Philippines, and Indonesia are considering cellular as a means to provide basic telephone infrastructure.

PRC

Mobile communications in China was re-organised in 1993 and now is run under the Mobile Communications Bureau, one of a series of operation bureaux being established under the Directorate General of Telecommunications (DGT) under MPT. The Mobile Communications Bureau was set up in 1993 with responsibility for cellular radio, radio paging and trouncing services.

The re-organisation follows the drawing up of new government policy requiring MPT to corporatise the Mobile Communications Bureau along with other DGT network operational bureaux in future.

At present all MPT cellular systems in service are operated by the Mobile Communications Corporation divisions of city PTAs including those in Beijing, Tianjin and Shanghai - three cities which because of their importance have been granted the status of autonomous regions for administrative purposes.

Since September 1993 the national regulatory authority for public mobile communications services is the State Radio Regulatory Commission, an independent body established under China's ruling State Council. Under Order 128 of the State Council and Central Military Commission that empowered the State Radio Regulatory Commission, the People's Liberation Army and its agency CESEC were made responsible for radio spectrum management of the AMPS-A band which has been assigned by the government for internal military use.

Although CESEC is entitled to set up private AMPS networks, MPT still has many opportunities to block attempts to set private cellular and other radio systems by hindering requests to provide essential connections with its PSTN telephone network. Currently this is holding up CESEC's network development plans.

Under MPT's organisational structure PTA cellular systems are planned and installed by the Mobile Communications divisions of city PTAs in agreement with their

provincial PTA and the provincial Mobile Communincations Bureau. The government has announced its intention to extend the availability of cellular services to a county level, which in future will mean cellular systems will be installed and operated by county PTAs.

County PTAs serve the local county, a government administrative area considered as third ranking in status below a province's major and second ranking cities. The latest expansion plan for Guangdong Province, for example, will involve installing cellular systems for several county PTAs for the first time.

Hong Kong

On July 1, 1993, after a recommendation in December 1992 by the Economic Service Branch, a new regulatory authority for telecommunications in the territory was created. OFTA, the Office of the Telecommunications Authority will be responsible for all aspects of Telecommunications policy. The Hong Kong Government's decision in late 1984 to grant cellular license to competing operators marked the beginning of telecommunications deregulation. Since then, three operators (Hutchison, Hong Kong Telecom CSL and Pacific Link) running four analogue networks have reached 252,000 subscribers by the end of May 1993.

In 1992, the three existing cellular operators were invited to convert their analogue systems to digital and a new GSM operator was selected. The digital plan was as follows:

- HK Telecom CSL will be able to convert its TACS network to GSM and will occupy 7.5MHz x 2 of spectrum eventually.
- Pacific Link is to convert its ETACS network into D-AMPS following the IS-54 standard and will eventually occupy 7.5 MHz x 2 of spectrum by June 1996.
- Hutchison is able to convert its TACS network into a GSM system and its AMPS network into CDMA with 7.5 MHz x 2 available ultimately for each system.
- Smartone is assigned 5.4 MHz x 2 within the top portion of the GSM band and eventually 7.5 MHz x 2 by June 1997.

By the end of September 1994, Hong Kong has 360,000 cellular subscribers, a 6.1% penetration. OFTA further announced the issuing of six PCN licenses and four PAC licenses in 1995, projecting a requirement of 1.2 million cellular users by 2000.

Comparisons between PRC and Hong Kong

With Unicom, China is on its way to break the cellular monopoly. However, Chinese Government has no intention to privatise or even accept outside shareholder in telecom operation. MPT has announced to accept a BTO (Bill-Transfer-Operate) co-operation model to induce foreign investment and management technique. With this model, MPT will appoint consultant company to build the network and transfer the ownership to MPT once completed.

In contrast to the regulation in China, OFTA in Hong Kong spends tremendous effort to drive down the tariff and handset pricing by encouraging extensive competition and parallel imported handsets.

Characteristics of the Cellular Market

PRC

Subscriber growth booms

Subscriber numbers are growing at a near exponential rate as cellular systems are implemented in major cities countrywide. China had 1.2 million subscribers at the end of September 1994. The 1994 year end national total is forecasted to reach 1.6 million subscribers.

Cellular services soon available countrywide

All 27 of China's 27 provinces and the three city provinces of Beijing, Shanghai and Tianjin are believed to have installed or are preparing to install cellular systems by the end of 1993. At present an estimated 268 cellular systems have been installed by city PTA operators including those operating both TACS-A and TACS-B systems and those operating TACS and AMPS systems.

Digital standard still to be announced

MPT has still to announce China's digital cellular standard for the 900MHz spectrum. However, GSM appears to be the de facto choice for the moment at least as MPT and China Unicom have plans to install about 12 provincial networks each by the end of 1995. Guangdong and Beijing PTAs have signed the GSM systems and Shanghai is expected to follow shortly.

Large potential market for cellular systems

Industry sources forecast that China will have about three million subscribers by the end of 1995, if 1.4 million new subscribers register as expected during 1994. By the year 2000 some 10.5 million users could be registered countrywide.

Guangdong has largest subscriber base

The largest number of subscribers live in Guangdong Province in southern China where 410,000 people had registered to use cellular telephones by the end of September 1994 according to Guangdong PTA. The 1994 year end total is forecasted to reach 532,000 subscribers, one third of China's national total subscribers.

TACS as a standard

China's total installed and on order cellular capacity at the end of December 1994 is forecasted to reach between 2.5 million to 3 million subscribers. About 95% of this capacity will be TACS.

Motorola the leading CMT brand

China is a handportable market with almost all terminals sold being handportable as very few people have cars. Motorola is firmly established as the leading cellular terminal brand with an estimated 75% cumulative market share in 1994. The Motorola 9900 LED type is the most popular terminal in China, while two

years earlier the 8800X is the most popular type. Nokia is second with 10% and NEC has about 5%.

More brands are being attracted to China as the subscriber size begins to grow quickly, also because Motorola is believed to be facing problems supplying sufficient terminals to keep pace with demand opening opportunities for other brands to get orders.

Recent price drop on enduser price

Recently due to the coming of the second network from Unicom in 1995, the MPT has adjusted the enduser price level of cellular phones. The price for Motorola 9900 had been adjusted from RMB18,000 to RMB15,000. The current price of RMB15,000 includes network connection fee of RMB5,000, registration fee of RMB 200 and other miscellaneous fee as Radio committee fee and insurance etc.

Type approval

MPT cellular handset type approval procedures changed in mid-1994. Importing agencies and local manufacturers must obtain model type approval and import sales volume approval from MPT to receive Permission to Connect (PTC) stickers in an effort to reduce illegal imports and tackle the serious copy number problem in Guangdong.

System Summary Table

The cellular networks in China is split into three sections: MPT, China Unicom and CESEC as shown in Exhibit 1 to 3. In each section, the supplier, technology used and the date opened in each city of each province are shown.

The cellular networks in Hong Kong by operators are shown in Exhibit 4.

CHAPTER II

CELLULAR NETWORKS

Since commissioning its first cellular system in 1987 China is estimated to have installed over 250 cellular systems nation-wide. Of these about 90% are TACS networks. The rest are mainly AMPS and GSM networks.

At the end of 1994 China was estimated to have installed cellular systems capable of supporting between 2.5 million to 3 million subscribers. About 95% of that capacity is available through TACS networks.

Interest in cellular mobile radio has spread rapidly since the beginning of 1992. All of China's 30 provinces have installed at least one cellular system serving the provincial capital and major cities.

Since 1993 most provinces have begun installing PTA TACS cellular systems in second ranking cities to meet the large potential demand for cellular services. In wealthy provinces such as Guangdong, plans already have been finalised to introduce cellular services to county ranking PTAs indicating the speed of economic growth in previously rural areas.

The rapid growth has been encouraged by the fact that subscribers pay their connection fees and terminal purchase cost in advance of receiving their handset and being connected, providing PTAs with a ready cash reserve to finance system development and purchase terminals. The fact that tariffs and terminal prices still are very high by international standards only underlines the attraction to otherwise cash-strapped PTAs of installing cash cow cellular networks.

Following the lead set by Hong Kong in selecting the TACS system standard, China's MPT also decided to adopt TACS as the national analogue cellular standard. The decision reflects the importance of Hong Kong's contribution to China's economic development. China's reason in choosing the TACS system was to allow roaming with Hong Kong and to help provide facilities for Hong Kong businessmen visiting China.

MPT controls the TACS-A and B bands along with 4 MHz of the GSM band. Second operator China Unicom has been allocated 6 MHz of the GSM band and 4 MHz of the AMPS-B band. CESEC, controlled by the PLA, retains its control of the AMPS-A band.

Until now most cellular systems have been installed in cities in southern China and along the east coast. Southern China, particularly Guangdong Province neighbouring Hong Kong, is one of China's most prosperous regions. Coastal areas in East China also are fast growing economic regions because of their international seaport connections and industrial development manufacturing a growing range of merchandise for the domestic market and export.

Under China's devolved telecommunications structure there are an estimated 2,000 provincial, municipal and county PTAs, many of which are considered potential cellular system operators. To this list can be added China Unicom's growing number of provincial operating units and CESEC command units throughout China.

System Growth

Subscriber numbers have grown at a rapid pace since the beginning of 1992 and are expected to continue growing at a near exponential rate of several years to come. According to MPT at the end of September 1994 China had 1.2 million cellular subscribers, almost double the 638,000 registered subscribers at the end of December 1993 and seven times the 175,000 registered subscribers in December 1992.

In fact cellular radio has only really begun to take off since the beginning of 1992. According to previous MPT statements China had just 47,000 cellular subscribers in December 1991, four years after the first cellular system was launched.

Future subscriber growth rates are hard to forecast accurately. However, many provinces expect strong subscriber increases to occur in the immediate future given that the decision to take out a subscription for senior managers in state run corporations, senior government officials, joint venture managers and high ranking personal in other enterprises are not thought to be dependent on the cost of cellular terminals and cellular tariffs.

In 1994 China is expected to register one million new subscribers pushing the national total up to 1.6 million subscribers. Forecasts suggest that the number of subscribers could double in 1995 and that an extra 1.5 million more subscribers could be added each year until the end of the century when about 10.5 million subscribers would be signed up nation-wide.

Barring unforeseen political or other upheavals there seems little reason why China's cellular industry should not achieve substantial subscriber growth rates. Subscriber growth will occur both through the increase in the number of cellular systems in service as well as the expansion of existing networks.

Already the cellular telephones has acquired the status of a highly prized gadget. Public demand already is well ahead of system capacity in many parts of China in spite of high cellular terminal prices and network connection fees.

Until now one effect of China's foreign exchange shortage on cellular system implementation and expansion is that actual foreign exchange budgets allocated to a PTA have not been tied always to an applicant's specific system development plans. The result has been that most cellular operators planned their system implementation or expansion programme once they received a foreign exchange allocation rather prepare a final plan before applying to the state authorities for the appropriate sum.

Migration to Digital Era

Since Hong Kong cellular operators began to implement digital cellular systems in 1992 China has begun to take a strong interest in developing digital cellular systems in most leading provinces. Installing digital cellular systems will allow the present roaming arrangements with Hong Kong to continue in future providing an important source of foreign exchange revenue for those Chinese provinces and cities attracting a high number of Hong Kong cellular subscriber businessmen.

With cellular subscriber figures rising rapidly each year China's interest in digital cellular technology increasingly is focused on providing sufficient capacity to support large subscriber numbers in future and less with simply installing state-of-the-art technology for its own sake. At present China has still to decide its digital standard(s) after originally appearing to have chosen GSM.

GSM

Although no official announcement has been made, fast pace developments during 1994 indicate that GSM is de facto the national digital standard for the moment at least. Newly formed China Unicom has been given 6 MHz of the GSM band and is planning a rapidly network installation programme. MPT, facing competition for the first time, is following suit by preparing to deploy GSM networks in all the major provinces during 1995.

Only recently has clearer picture begun to emerge. In early 1993 China first appeared to have selected GSM as its digital standard after Alcatel installed a GSM system in Jiaxing and Ericsson received an order for a GSM system in Guangdong. About the same time Siemens was promised orders for GSM equipment in Shanghai after signing a joint venture agreement with parties including Shanghai PTA to set up a joint venture plant in the city making GSM equipment.

However, by the third quarter of 1993 MPT had began asking PTAs not to develop their proposed GSM systems too rapidly pending the selection of a digital standard. This was followed by an announcement at the end of 1993 that MPT would conduct a CDMA trial with Qualcomm using the 900 MHz and other frequencies.

After asking PTAs to slow down their GSM plans pending the outcome of the CDMA trial, government approval at the beginning of 1994 for the formation of China Unicom, prompted MPT to change track and encourage more PTAs to install GSM systems as a blocking move to prevent China Unicom or other potential second operators from gaining access to unused GSM frequencies in various parts of the country.

After conducting a three month CDMA trial with Qualcomm that ended in 1994, MPT has been spurred into action with the formulation of China Unicom and its ambitious plans to capture 30% of China's cellular market by 2000. Although MPT's TACS network is expected to remain the major network for the foreseeable future,

MPT is encouraging provincial PTAs to place strong emphasis on developing GSM networks to compete with China Unicom in future.

Recently in Guangdong MPT commissioned four GSM networks, one supplied by Ericsson covering Guangzhou and the Pearl River Delta, a Siemens system in Shenzhen, and Italtel system in Zhuhai and a Northern Telecom system in Huizhou. Previously in early 1994 Guangdong PTA became a signatory to the GSM system after attending a meeting in Europe, while Beijing PTA became China's second signatory, further signs that China expects to develop GSM systems fully in future.

Elsewhere in China Jiaxing PTA's GSM system has been commercially operational for about one year. Both Beijing PTA and Shanghai PTA expect to launch GSM networks before the end of 1994, followed by Tianjin PTA in mid-1995.

CDMA

With the results of the joint MPT-Qualcomm three month CDMA trial in Tianjin which ended in June 1994 recently announced, many industry observers believe that China may be about to adopt more than on digital cellular standard for the 900 MHz band. Details of the trial are given later though it seems that MPT's primary interest is rolling out GSM networks for the moment with CDMA likely to be employed as a second generation digital technology.

D-AMPS

The possibility of digital AMPS being used in China lies with the CESEC's plans to set up private cellular networks which eventually are planned also to be available for public use. CESEC's interest in D-AMPS stems from concern to maximise the subscriber capacity which its frequency can support.

Due to CESEC's structure both local as well as national units may try to establish cellular services within the same geographical area, possibly requiring the sharing of frequency to accommodate all parties. Currently CESEC technocrats are considering the advantages of D-AMPS compared with E-TDMA and CDMA technology and have yet to make any decision about a PLA digital standard.

E-TDMA

E-TDMA cellular technology is being promoted in China by Huges Network Systems, division of Hughes Aircraft Corp of the US. Although E-TDMA is non-standard, Hughes has installed one E-TDMA system in Chengdu in Sichuan Province and hopes to supply another one to Daqing, Heilongjiang.

Although MPT delayed interconnecting the Chengdu system with the PSTN public telephone network, the delay arose over the role of the Hong Kong company Champion in the project and not the question of E-TDMA technology.

In both the Chengdu and Daqing projects the systems are planned to provide fixed telephone lines as well as cellular capacity. City governments with the local CESEC units and the local PTA have been prime movers in both cities with more municipalities apparently interested installing E-TDMA systems future.

Market Analysis in Selected Areas

MPT mobile communications in China was re-organised in 1993 and now is run under the Mobile Communications Bureau, one of a series of operations bureaux being established under the Directorate General of Telecommunications (DGT) under MPT. The Mobile Communications Bureau was set up in 1993 with responsibility for cellular radio, radio paging and trunking services.

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Council and Central Military Commission that empowered the State Radio Regulatory Commission, the People's Liberation Army was made responsible for radio spectrum management of the AMPS-A band which has been assigned by the government for internal military use.

Recently the number of cities with two cellular systems has been growing. The idea of operating TACS-A and B systems began in Beijing and Shanghai with each having one Motorola and one Ericsson system in service. These are run back-to-back and not marketed as separate systems to subscribers.

The idea has been to have two equipment suppliers with the intention of trying to make the two suppliers compete in price and other service detail for expansion orders. This practice has spread to some major PTA operators in other provinces including Heilongjiang, Hubei, Inner Mongolia, Jiangsu, Liaoning, Sichuan, Yunnan and Zhejiang.

Beijing

Beijing, the capital of China, is located in Hebei Province, but has been accorded the status of an autonomous region by the government. At present Beijing is served by two cellular systems. These are both run by the Beijing PTA which operates them in parallel rather than as competing networks. The capital's cellular services will be expanded when Beijing PTA launches a GSM system before the end of 1994 while China Unicom plans to start up a GSM system in mid-1995.

Beijing Telecommunications Administration (BTA), which operates cellular telephony and paging under Beijing Radio Telecommunications Bureau, is facing a sharp increase in demand for cellular telephones. However, due to financial constraints and other factors BTA has not been able to expand its system sufficiently so far to match subscriber demand. Because of limitations in cellular capacity BTA is giving priority to meeting subscriber demand from government departments, state-owned enterprises, collectives and foreign joint venture companies.

Private cellular subscribers have signed up in large numbers in 1994 as more subscriber capacity became available for all subscriber categories to be served. In the first quarter of 1994, for example, some 60% of the 9,200 new subscribers registering were categorised as being private subscribers, reflecting the greater personal wealth that has developed in Beijing recently.

According to industry sources both the Beijing TACS-A and B systems have been run at over capacity with a consequent poor level of service in many areas of the city. Call connections are difficult to make and the call quality poor.

Different areas of the capital experience different peak calling periods. East Beijing, for example, is where many foreign diplomatic missions and many foreign companies' offices are located. A different working day pattern is evident here compared with other areas of Beijing.

Generally the morning peak cellular call time occurs between 10am to 11am. Call frequency drops during the lunch hour before the afternoon peak period running from 1pm to 4pm or 5pm occurs.

Although BTA offers a range of value added services such as call transfer, conferencing and call waiting, little publicity is given to these features and subscribers are not encouraged to use them. The reason is that BTA is concerned that these features may prove popular encouraging more people to apply for cellular telephones at a time when it still cannot meet present demand.

Over the past few years BTA has seen a strong growth in subscriber numbers, limited by its system capacity. An estimated 15,000 subscribers used the service in December 1992 rising to 30,800 subscribers in December 1993. BTA has forecasted that subscriber numbers will rise to 70,000 by the end of December 1994 when plans call for the combined TACS-A and B systems to support a total of 100,000 subscribers. Actual growth now seems to have been greater than expected this year with about 87,000 subscribers expected to be registered at the end of 1994 (See Exhibit 5).

Future subscriber growth is matter of conjecture. After adding about 56,000 subscribers in 1994 it seems likely that a similar number or more will register in 1995.

Beijing has population totalling more than 12 million people. As China's political capital and an important industrial and business centre, Beijing is expected to develop a large cellular subscriber base in future.

Quite how this growing cellular base is supported remains to be seen. After starting with TACS, BTA is preparing to launch a trial GSM systems by the end of 1994. BTA also is looking at CDMA with interest and is waiting for MPT to decide a CDMA policy.

Shanghai

Shanghai, one of China's major seaport and industrial centres, is another city granted the status of an autonomous region. Recently Shanghai has begun to enjoy rapid economic development with many foreign joint venture companies and other investment activities being attracted to the city. Ambitious plans are underway to develop the greenfield Pudong area as a new economic zone along with other areas around the city. Currently the city is enjoying a construction boom as new businesses are attracted to the city and demand for telecommunications services also grows rapidly as a result.

Currently Shanghai is served by two analogue cellular systems. Both are run by Shanghai PTA which plans to launch a Siemens GSM system before the end of 1994 as part of plans to expand services to cope with the continuing surge in demand for cellular services.

Shanghai PTA would find no difficulty in signing up more subscribers if it could expand its cellular services faster. However, Shanghai PTA is constrained for investment as the authority also is trying to expand other public telecommunications facilities at the same time.

Subscriber growth

Industry sources suggest that actual subscriber figures in Shanghai are higher than official figures as the networks are run at more than their designed capacity. Officially Shanghai PTA had some 55,000 TACS subscribers in June 1994 rising to 65,000 at the end of September with some 75,000 forecasted for the end of 1994. Unofficially it is believed the real subscriber figure could reach 96,000 by the year end.

Shanghai PTA is expecting strong growth in 1995 as both its TACS systems are expanded and the GSM network is commissioned. By the end of 1995 the PTA expects to have a total 190,000 capacity (180,000 TACS and 10,000 GSM) with 120,000 subscribers (110,000 TACS and 10,000 GSM). Future subscriber growth is likely to depend on the systems being expanded at a fast enough rate for several years to come (Exhibit 6).

Shanghai city province has over 15 million inhabitants. Until recently cellular services covered only the main areas of the city. Work is now being completed to extend coverage up to the city boundaries including various new economic zones now

under construction which are planned to re-establish Shanghai as one of Asia's major industrial centres.

At present two Motorola and Ericsson TACS systems are estimated to serve a combined total of about 90,000 subscribers, 20% more than the networks' designed capacity. In spite of this, Shanghai's rapid economic expansion has created a lengthy waiting list for cellular registrations, partly because Shanghai PTA's controlled cellular terminal prices are about the lowest in China.

Shanghai, like Beijing, has suffered from a poor service quality in some areas due to higher than planned subscriber numbers using the system. Problems occur where social functions in hotels and other places attract a large number of people carrying the handportable terminals. Shanghai PTA is carrying out some cell splits to improve its service. The authority is discussing the possibility of installing microcells in hot sports throughout the city in future which could provide a suitable solution.

Guangdong Province

Guangdong Province in southern China has developed the China's largest cellular subscriber base since the capital city Guangzhou commissioned the province's first network in 1987. At the end of December 1994 some 532,000 cellular subscribers are forecasted to be registered in Guangdong accounting for about 33% China's total expected 1.6 million cellular users. Guangdong will remain one of the leading cellular provinces in future though cellular use will grow quickly elsewhere in China.

Telecommunications in Guangdong is the responsibility of Guangdong PTA's mobile division known as Guangdong Mobile Communication Corporation (GMCC) which until now has ordered all analogue TACS cellular infrastructure equipment from Ericsson. So far Guangdong PTA has implemented cellular systems in 14 cities and Special Economic Zones. Eleven more city TACS systems are due to enter service by June 1995 when 25 PTA cellular networks will be in operation.

With foreign investment pouring into Guangdong, in complete contrast to the slump between 1989 and 1991, the province has become one of China's fastest economic development areas. Guangdong has a population of 65 million people. The capital Guangzhou has about four million inhabitants while Shenzhen Special Economic Zone, bordering Hong Kong, has about two million.

For the moment public telecommunications in Guangdong is run by more than 120 PTAs. Some 26 cities each have their own city PTA while over 100 counties also have their own PTAs. Strong economic growth and expanding industrialisation in many parts of Guangdong has resulted in Guangdong provincial government regularly creating new counties and cities by upgrading individual localities' status to reflect their economic and social development performance. This, in turn, leads to new PTAs and other utilities being formed to serve the local population.

Although Guangdong has installed 14 city cellular systems and will have 11 more networks by mid-1995, these cellular networks cover more than their city PTA's normal fixed telephone line service area. The cellular operators serve areas outside of

their normal public switched telephone network (PSTN) service area as it is more economical for coverage to be arranged this way than for each PTA to have its own system.

Compared with other important centres in China, Guangdong has about six times the number of subscribers in Beijing and about five times Shanghai's current number of subscribers.

Subscriber growth

Since 1988 Guangdong's total number of cellular subscribers has doubled or slightly more than doubled most years. This trend continues up to now with the number of subscribers forecasted to grow to about 532,000 by the end of the 1994 compared with about 220,000 at the end of 1993 and 100,000 at the end of 1992.

According to present forecasts GMCC believes the subscriber growth rate could stabilise in 1995 after doubling in 1994. This would mean between 250,000 to 300,000 new subscribers registering in 1995 encouraged by lower cellular handset prices and tariff rates as well as the opening of the GSM network. Some observers believe subscriber registrations could grow faster than GMCC forecasts in 1995 possibly reaching a provincial total of one million subscribers at the year end.

One figure which is impossible to accurately forecast is the number of GSM subscribers Guangdong will have at the end of 1995. GMCC will begin registering GSM subscribers in early 1995, though the year end total will depend on how

registrations are organised and the pace at which the various GSM networks are expanded.

During the second half of the 1990s GMCC expects subscriber growth to stabilise at about 150,000 new registrations each year. With the TACS system expected to be full about the beginning of 1997 all future growth will be in digital system capacity. By the year 2000 about 1.5 million to 2 million subscribers are expected to be registered in Guangdong while estimate for total subscribers in China at that time suggest about 10.5 million users (Exhibit 7).

Hong Kong

The Hong Kong Government's decision in late 1984 to grant cellular license to competing operators marked the beginning of telecommunications deregulation. Since then, three operators (Hutchison, Hong Kong Telecom CSL and Pacific Link) running four analogue networks have reached 252,000 subscribers by the end of May 1993.

In 1992, the three existing cellular operators were invited to convert their analogue systems to digital and a new GSM operator was selected. The digital plan was as follows:

- HK Telecom CSL will be able to convert its TACS network to GSM and will occupy 7.5MHz x 2 of spectrum eventually.
- Pacific Link is to convert its ETACS network into D-AMPS following the IS-54 standard and will eventually occupy 7.5 MHz x 2 of spectrum by June 1996.

- Hutchison is able to convert its TACS network into a GSM system and its AMPS network into CDMA with 7.5 MHz x 2 available ultimately for each system.
- Smartone is assigned 5.4 MHz x 2 within the top portion of the GSM band and eventually 7.5 MHz x 2 by June 1997.

Both CSL and Smartone had launched three GSM networks in 1993. With the continuous lowering of the handset pricing, the total market size have been expanded. By the end of September 1994, Hong Kong has 360,000 cellular subscribers, a 6.1% penetration.

Subscriber Growth

OFTA announced the issuing of six PCN licenses and four PAC licenses in 1995, projecting a requirement of 1.2 million cellular users by 2000. As Hong Kong is a very dynamic market, the total market size is expected to have further expansion.

CHAPTER III

CELLULAR TERMINAL MARKET

Market Potential

Market potential is the total demand for a product in a given environment. Market size can be expressed as total market sales potential in a given market. Companies have to evaluate the market potential and size before defining the strategies.

PRC

Since commissioning its first cellular network in 1987, China has installed over 100 cellular systems countrywide. Interest in cellular mobile radio has spread like wildfire during the past 24 months with nearly every city and many localities interested in installing a cellular system. By the end of 1994, China has 1.5 million cellular phone owners and according to MPT source, by the year of 2000, China may have 10.5 million cellular users (Exhibit 8 and 9).

China's unforeseen exponential subscriber growth rate has made accurate subscriber forecasting very difficult. Until now subscriber increases has not been dependent on tariff or terminal price level. This is because most subscribers are

corporate, government and joint venture officials whose organisation are able to afford terminals price that are very expensive by Chinese and international standards.

Hong Kong

While market demand for cellular continues to grow, spectrum constraints have limited the scope for expanding existing analogue cellular systems. The transition to digital cellular technology is being undertaken to alleviate these analogue supply-side constraints. At the same time, however, there has been continued development in technology for the provision of new and innovative mobile service technologies, for example, as in "Personal Communications Networks" (PCN) concepts.

The recent issued "Guidance Notes for the Submission of Proposals for the Operation of Personal Communications Services (PCS) and Cordless Access Services (CAS) in Hong Kong" invited interested parties to submit proposals. Up to 6 PCS licenses and up to 4 CAS licenses will be issued in this invitation exercise. The overall estimated capacity of 6 PCS networks would be 1,250,000 customers.

Subscriber Distribution

People make up markets and subscriber distribution is important for marketing planner to focus on selected territories.

PRC

Guangdong Province in Southern China has the largest subscriber base at present with some 532,000 subscribers having signed up by December 1994 since Guangdong's first city system was launched in Guangzhou in 1987. Guangdong's present booming economy, due to its proximity to Hong Kong, which provides a large number of roamers and also influence the social and business habits of southern China, is expected to ensure that the province remains China's largest cellular market in future. About one-third of China's forecasted 1.5 million subscribers at the end of 1994 are expected to live in Guangdong. The surge in cellular demand was total unforeseen on such a scale as little as one year ago.

Beijing and Shanghai are expected to remain the two other largest cellular markets in the near future. Beijing has about 87,000 subscribers at present and Shanghai about 96,000 subscribers.

Hong Kong

Cellular mobile services have been available to customers in Hong Kong since 1984. New services have been progressively introduced to the market since that time and there is currently four licensed operators providing cellular services. These are:

Hutchison Telephone Company Limited ("Hutchison");

Hong Kong Telecom CSL Limited ("CSL");

Pacific Link Communications Limited ("Pacific-Link") and

SmartTone Mobile Communications Limited ("SmarTone").

Following the launch of Hutchison's first network it quickly established itself as the major provider of cellular services in Hong Kong. Combined with its association with Motorola, which provided it with high quality handsets, Hutchison has been able to establish a market leadership position with an approximate current (September 1994) market share of 31%, 105,400 subscribers in both AMPS and TACS networks. Both of Hutchison's network have now reached their effective capacity which means that its growth is now limited. In 1995, Hutchison intended to roll out two digital networks to replace its analogue networks. The new networks will use different technologies - one Code Division Multiple Access ("CDMA") and the other being Global System for Mobile ("GSM").

CSL launched the first of its current networks when it launched its TACS analogue in March 1987. It launched its second current network being GSM digital in July 1993. CSL's early entry and its association with HKT have enabled it to capture a current (September 1994) market share of approximately 33%, 112,200 subscribers in both networks. CSL's TACS network is near its capacity limitation and the overall focus is its GSM network where it has available capacity. CSL is positioned at the "high end " of the market. Its customer base is understood to be generally older, have higher income and be more socially secure than that of its competitors.

Pacific-Link entered the Hong Kong cellular market when it launched its Extended Total Access Communications System ("ETACS") analogue network in

September 1989. Pacific-Link launched a US digital AMPS network employing Time Division Multiple Access ("TDMA") technology in October 1992 and its current (September 1994) market share is 20%, 70,000 subscribers. Pacific-Link's analogue network has reached its effective capacity and the main focus lies with the development of its digital network where it has available capacity. At present, its digital network does not match the coverage and messaging features of CSL'network. Pacific Link is targeting the mass market with low priced handset and low tariff strategy and thus her customers in the "low end" range.

Unlike the other operators SmarTone operates a single GSM network only. In the relatively short period of time it has acquired a current (September 1994) market share of approximately 15%, 52,000 subscribers. SmarTone's regulated low tariffs have enabled it to establish the largest subscriber base among Hong Kong's three digital networks. Smartone has less spectrum available to it compared with its competitors and has a correspondingly lower available capacity. From the present estimation of subscriber growth and usage pattern, this capacity limit may be reached by mid 1995. Same as Pacific Link, Smartone is at targeting the "low end" market range by offering low tariff and low handset price to her customers.

Subscriber Growth

Subscriber growth reflects the secular trend of the industry and it provides a measure of estimated company growth and share.

PRC

Subscriber growth rates have increased exponentially since 1992 taking Chinese PTAs and foreign equipment suppliers by surprise. Before 1989, only a few systems have been installed and subscriber numbers were very small for a country of China's size. A fall in foreign and local investment after 1989 resulted in demand for cellular telephones remaining low with the rapid rise in subscriber demand following the economic pick up from 1991 onwards. China's economic boom and a rapid increasing in demand for cellular suggests that past subscriber growth rates will not provide a useful guide to future growth expectations. According to MPT sources China had 47,000 subscribers at the end of 1991 (of which two-third were in Guangdong) rising to 82,000 subscribers at the end of June 1992 before reaching 175,000 at the end of December 1992 (Exhibit 10 and 11).

At present subscriber growth is not price dependent as most subscribers are company officials and also some government officials whose organisation are easily able to afford cellular terminals prices that are expensive relative to average Chinese wage levels and terminal costs in other Asian countries. Many operators believe their system will expand for some time yet based on a waiting list of company and government funded subscriber applications. Once this group has registered future growth will be achieved by aiming at potential subscribers with more limited budgets. In fact, PTAs have started to lower cellular prices to attract more users and compete with the second carrier, Unicom.

While China's cellular subscriber growth is hard to forecast it is clear that many equipment suppliers feel the market is big enough to make a major commitment to China. Ericsson, Motorola, Alcatel, AT&T and other companies have all made plan to set up local production or are preparing to do so while other major equipment suppliers also are expected to target China where the eventual subscriber total could be several million people before the end of the century.

Hong Kong

Since the analogue market reached its growth peak in 1991, there has been a slowing down in subscriber growth simply due to the capacity constraint. With the introduction of digital network in 1993, the growth regains the momentum. In 1994, the growth rate is estimated to be 120%, partly due to the government policy and partly because of the tremendous price reduction in handset. However, this increase has imposed severe impact on capacity in the GSM networks. OFTA's recently predicted the subscriber will grow to 1.2 million by the end of 1990s and will issued 10 new licenses to cater for this. It is reasonable to assume that the total market size has been expanded by reducing the handset pricing. OFTA has requested operators to offer competitive tariff and handsets, however, the future growth rate will very much depend on the operator's attitude in capturing market share (Exhibit 12).

Black Market

The efficient information flow and price difference between different countries has induced the inflow of product from a low priced country to a high priced country. This kind of activities help to regulate the global pricing.

PRC

The recent development of a black market in handportable terminals in China has become a problem for more than 3 years. The CMT are supplied to China from Hong Kong along with black market radio pagers. Some sources say the CMTs are smuggled into China aboard high speed motor boat to outwit custom officials. Others believed the CMTs may be imported illegally.

It appears that black market CMTs are supplied through city PTA cellular operators as subscribers have virtually no other means of obtaining a cellular telephone number though some black marketers apparently offer a cloning service. Opinions vary and some sources believe that many subscribers do not know the CMT they are purchasing is a black market model.

Guangdong Province appears most affected by the black market problem though some black market terminals also are believed to have appeared in Shanghai. Other PTA are strictly controlled though whether black market problems spread to other provinces in future remains to be seen.

Hong Kong

The import duty of cellular handset is 0.5% and this does not create any import barrier for black market activities. Parallel importers organise the purchase of handsets in overseas markets (mainly Europe and USA) and arrange their importation to Hong Kong. Parallel importers, which range in size and scope of operation, have no association with the network operators. They act on their own behalf and provide Hong Kong's consumers with handset only. Consumers then have to approach a network operator to gain access to a network to be able to use the handset. These parallel imported handsets may not always be ideally suited to Hong Kong market in terms of quality and features. In addition, parallel importers offer no warranty or after sales service for the handsets they provide.

The cost of handsets bought through parallel importers are substantially below those bought through the network operators or their dealers. Industry sources indicate that the presence and activities of the parallel importers have been the main catalyst for the general reduction in handset prices that has occurred in Hong Kong over the past 12 months.

The extent to which parallel importers account for new connections differ across the existing four operators. With its specific commitments to accommodate customers with handsets purchased through parallel importers, Smartone currently has the largest share among the four operators of the handsets sourced through this channel. This is also a function of the types of handsets that are available to parallel importers and their compatibility with the different Hong Kong networks. Pacific-

Link, in contrast to Smartone, virtually has no handsets connected to its digital network sourced from parallel importers. This is due to the incompatibility of the predominantly GSM handsets that are sourced from parallel importers with Pacific-Link's digital AMPS network.

Roaming

PRC

All cellular systems installed in the Guangdong Province have automatic roaming capability with each other. Automatic roaming also has been launched in Beijing and the nearby port city of Tianjin, including the interconnection highway, for subscribers on the Ericsson systems installed in each city. Elsewhere Shanghai PTA has automatic roaming with Jiangsu and Zhejiang Provinces for both its Motorola TACS A and Ericsson TACS B systems in 1994.

Roaming arrangements vary among other provinces in China. MPT's target is for each province to achieve automatic roaming capability at first and then automatic roaming to be established nation-wide though no time schedule has been announced for this program target. National roaming is being established using manual roaming initially except for the Beijing-Tianjin automatic roaming system.

International roaming will be established at a later stage. Several Chinese provincial PTAs have established roaming agreement with Hong Kong and Macau.

However, both Hong Kong and Macau are regarded as part of China and these agreements are not viewed as international roaming.

Hong Kong

85% roaming customers in Hong Kong are looking for services in China. With the new GSM operation, international roaming is much easier and operators have expanded their services to cover most of European countries. However, the dominant market is still the businessmen working in China.

CSL Unitacs China Roaming

CSL's roaming service with the Guangdong network started in November 1987, as soon as the PRC service had commenced operation. Unitacs was the first network to have signed roaming agreements with Guangdong and now has a roamer base of 12,000.

TCSL signed a Master Roaming Agreement with the MPT in May 92 which set out the standard procedures in roaming registration and accounts settlement, standardise tariffs and dealt with radio signal overspill along the coastal border areas with the PRC.

Roamers are billed monthly by HKT-CSL in HK$ at a fixed exchange rate. Currently, CSL has the most extensively roaming network covers 100 destinations in China.

Hutchison China Roaming

Apart from a service link agreement with the Beijing Telecommunication Administration, Hutchison has a roaming agreement with Shanghai PTA. Reservations for service are made with Hutchison's Hong Kong office 14 days in advance, where a mobile telephone number is assigned to the customer for use.

Pacific Link I-TACS China Roaming

Together with Ericsson, Pacific Link signed a contract in 1990 with the Post and Telecommunications Ministry of the PRC, to install a cellular network in Beijing to cater for 2,000 subscriber in times for the Asian Games in September. The BTA received the network free from Ericsson in return for allowing Pacific Link subscribers to roam in Beijing. Besides this, Pacific Link has yet no other roaming agreement with China.

CHAPTER IV

CUSTOMERS

Preference

Under the deregulated market in Hong Kong, suppliers are free to sell their products to different cellular operators so long as they have got the type-approval certificate and the product itself is competitive. Products from the market which is not properly type-approved can also be sold and even be connected to the cellular operators so long as customers pay the connection fee. Customers can therefore have a lot of choices. However, in the regulated market in PRC, customers have limited choice only. They can only buy the CMT from the PTA's retail channels and CMT not bought from PTA is not allow to connect to their network.

As Motorola handsets had gained a 80% market share, and due to their high reliability, good maintenance support and easy accessibility of different spares, most of the PTAs will keep most of their stock for Motorola. However, if particular PTA want to promote for other brands, it is always very easy by saying that Motorola is out of stock and only other brands are available.

Consumption Trends

At this moment, most of the subscribers are corporate, government and joint venture officials whose organisations are able to afford cellular terminals prices that are very expensive by Chinese and international standards.

Many PTA operators believe their systems will expand for some time yet based on their current waiting list of company and government-funded subscriber applications. Once most of this group has registered future growth will be achieved by registering lower ranking potential subscribers in the same organisations.

Whether the round of tariff and cellular handset price reductions which has occurred during 1994 has any effect on subscriber growth will be hard to gauge given that most subscriptions are company paid. If the price cuts have had any effect then it would be to stimulate public demand further.

In Guangdong, for example, since early 1993 a trend has emerged for deputy heads of organisations to become cellular subscribers - following the steps of their bosses. About 70% of subscribers in Guangdong are members of large corporations, organisations or private companies. Some 30% of subscribers are private individual businessmen: a trend which is expected to emerge in other provinces once sufficient subscriber capacity is available to allow individuals to register.

Longer term cellular subscriber growth to the end of the century is hard to forecast though a figure of 10 million to 11 million is being talked about. Two

intriguing questions concern the market share forecasts for each of the network operator groups and the split of subscribers among the various cellular technologies.

In terms of the cellular technology market shares TACS is expected to remain the major frequency given its strong standing at present. One industry estimate is that TACS will retain a 50% share of all subscribers by 2000 while both GSM and CDMA will have 20% each, if China decides to employ CDMA in future.

Given this scenario AMPS will support about 5% of subscribers and various other technologies the rest. These estimates will be subject to constant revision as the true picture emerges in future.

Segments

The cellular can basically be divided into handportable and car phone. Although cellular telephony has only developed into a mass market service since 1991, China already has developed into an almost entirely handportable market. The fact that very few people own cars is the major reason for this. Also following the fashion in Hong Kong, many cellular subscribers like to be seen carrying portable phones which are known as "Big Brother" in Chinese and have become an important status symbol.

Although car mounted CMT's cost about half the price of handportables in China, handportables account for about 99% of the current terminal market. Among

leading brands only Motorola offers a car-mounted terminal as part of its range; to supply the small market for terminals installed in official cars.

Subscriber Charges

The DGT under China's Ministry of Post and Telecommunications has recommended standard tariff rates for all of Chin's cellular operators. Call time charges are believed to average RMB 0.5 Yuan per minute for calls made locally in most provinces while long distance calls are charged at RMB Yuan 0.5 per minute to which is added the cost of the long distance call tariff.

DGT guideline tariffs are not used by all operators with some PTSs using local discretion in setting tariffs. Tariffs used in Shanghai, Guangdong and Beijing are given below. All operators in Guangdong charge the same tariffs. Figures quoted do not include the cost of cellular terminals which is discussed later though many PTAs prefer to quote a combined cellular terminal purchase and network connection fee.

Around the end of 1993 MPT officials carried out a national survey of cellular tariffs comparing charges with other cost of living induces. The conclusion was that cellular tariffs were higher than other comparable service costs in China and should be reduced to fall into line in living costs in general.

As a result almost all PTAs changed their tariffs in 1994. Most tariff changes were reductions apart from a few exceptions. Exhibit 13 to 15 are the tariff tables for some large cities like Beijing, Guangdong and Shanghai.

CHAPTER V

COMPETITORS

Knowing one's competitors is critical in effective marketing planning. A company has to compare its product, price, channel and promotion with its close competitors. Through this, the company can identify areas of competitors as well as prepare strong defences against attacks.

Cellular Infrastructure Suppliers

PRC

About 12 foreign companies - Alcatel, AT&T, Ericsson, Hughes, Itatel, Motorola, NEC, Nokia, Northern Telecom, Novatel, Siemens and Stanilite have supplied cellular systems to China so far. Most cellular infrastructure vendors are involved in supplying a wider range of telecommunications equipment than cellular systems. Following the rapid growth in the number of cellular systems in operation during the past two years, several market leaders have begun to emerge in the supply of cellular systems. However, new opportunities appear almost daily attracting new vendors to this huge market.

TACS systems market

China's TACS systems market is now totally dominated by Ericsson and Motorola, with the MPT unofficially having assigned the TACS-A band to Motorola systems and TACS-B to Ericsson networks. Motorola has supplied about 150 TACS systems so far, while Ericsson has supplied about 90 systems. Both suppliers are due to establish national automatic roaming among their own TACS networks by the end of 1994. In future MPT wants the two companies to co-operate in establishing automatic roaming between the two networks. In future many PTAs throughout China are expected to use both Ericsson and Motorola to supply cellular infrastructure equipment. The PTA's idea is to use two suppliers to obtain a lower purchase price. A good number have adopted this system already as evidence by Motorola's penetration of provinces previously ordered from Ericsson only and vice versa.

GSM systems market

The government's decision to appoint Unicom as China's second operator with 6 MHz of the GSM frequency to launch cellular services has attracted the attention of all the world's leading GSM network suppliers. Currently MPT and Unicom are both trying to deploy GSM systems in about 12 developed coastal provinces with the bulk of the infrastructure orders have been awarded. MPT has awarded the Shanghai and Beijing orders to Motorola and Siemens while Ericsson, Italtel, Northern Telecom and Siemens have installed GSM systems in Guangdong. In contrary, Unicom decided to install all Motorola and Siemens equipment in Beijing, Shanghai, Tianjin and Guangzhou.

AMPS market

Up until recently the only AMPS systems in operation were four AT&T systems supplied at lower than TACS systems cost to PTAs in four less well developed provinces which has obtained MPT permission to set up AMPS networks. Now the AMPS network market is beginning to change as CESEC, which controls the AMPS-A band, begins to set up private systems in an increasing number of provinces. Four suppliers has won AMPS systems contracts so far. Ericsson has installed an AMPS system in Beihai in Guangxi province and is supplying another in Nanjing in Jiangsu Province. Northern Telecom has installed AMPS systems in Guangzhou and Shenzhen in Guangdong Province, and is installing one in Chengdu in Sichuan. Motorola is installing private AMPS in Hangzhou in Zhejiang, Haikou in Hainan and Shijiazhuang in Hebei. AT&T is supplying a system to Jinan in Shandong. Hughes Network Systems, meanwhile, has installed an E-TDMA system in Sichuan Province.

Ericsson

Ericsson is the leading supplier of cellular infrastructure equipment to China so far in terms of subscriber capacity accounting for an estimated 70% of total cellular system equipment installed or on order at present (Exhibit 16). By October 1994 Ericsson had signed contracts for equipment installed or on order in 15 provinces to provide a total 1.6 million subscriber capacity which is estimated to be just over two thirds of China's installed and on order cellular capacity. Cellular development in Guangdong Province continues to assure Ericsson as position as one of the top two players in China's cellular market. The company has supplied all TACS cellular

infrastructure equipment installed in Guangdong so far and is one of four companies which supplied GSM systems commissioned in October 1994. Although Guangdong province is Ericsson's largest provincial market by far, the company is developing business in a growing number of other provinces. Recently the company was awarded a large contract by Liaoning Provincial PTA for the installation of one of the largest cellular networks in China after Guangdong and Shanghai. Meanwhile, Shanghai and other PTA clients throughout China increasingly are being supplied from Ericsson's second joint venture cellular equipment factory in Nanjing.

Motorola

Motorola was the first supplier to install a cellular system in China after winning contracts in Beijing and Shanghai. The company is China's largest supplier in terms of the number of cellular systems installed and on order, and ranked second after Ericsson in terms of radio channel subscriber capacity installed and on order. At the end of October 1994 Motorola had over 140 TACS, GSM and private AMPS cellular systems installed or on order for 22 provinces throughout China (See Exhibit 1 to 3 for Motorola's installed systems in China). Much of Motorola's success in signing new system contracts in China has stemmed from its decision to sign licensing agreements with the Posts and Telecommunications Industries Corporation of China (PTIC) established under China's MPT to make cellular equipment at Hangzhou Communication Equipment Factory in Zhejiang Province. The MPT connection is believed to be important when discussing sales contracts with prospective provincial and city PTA customers all over China though signing up the provincial capital PTA as customer does not necessarily ensure all secondary PTAs choose a Motorola system.

With China moving into the digital cellular era, Motorola is looking to begin joint venture production of digital infrastructure equipment in near future. To serve this huge market, Motorola offices in Hong Kong and Guangzhou are concerned mainly with supplying cellular terminals to Guangdong Province and Southern China. Infrastructure sales also are handled by representative offices in Beijing, Shanghai and Harbin. At present, Motorola employs about 250 people in China for its cellular activities only. At present Motorola China Electronics Ltd which is a registered Chinese company is headquartered at the Tianjin factory, while Motorola is setting up a Beijing-based cellular customer support infrastructure to serve the whole of China.

Hong Kong

Hong Kong has four operators running 7 networks employing four different technologies namely TACS, AMPS, GSM and TDMA. The major infrastructure suppliers are Motorola, Ericsson, Nokia and NEC. While Motorola has long exclusivity to supply infrastructure to Hutchison and NEC supplies to CSL only, Ericsson and Nokia are working aggressively especially in the GSM technology.

Ericsson

Ericsson supplies a TACS system and a TDMA system to Pacific Link and a GSM system to SmarTone. Ericsson Hong Kong Office support both Hong Kong and Southern China. It handles the terminal business as well.

Nokia

Nokia is no well known in Hong Kong and supplies a GSM network to CSL only. Nokia is promoting aggressively her brand name and targeting for the PCN market.

Motorola

Motorola owns 30% equity of Hutchison Telecom Ltd and Motorola supplies exclusively to Hutchison. Currently, Motorola supplied both the TACS and AMPS systems to Hutchison Telephone and will supply the GSM and CDMA systems as well.

Cellular Terminal Supplier

PRC

TACS products dominates China's public terminal market as a consequence of MPT having selected TACS as the national operating standard. At present most new brands entering the China market are offering TACS handset, though makers of GSM products are showing strong interest in the market. The cellular terminal market will diversify further in future as China moves into the digital era. GSM handsets are the next major new product group to enter the market. At present over 16 foreign cellular terminal brands are believed to be in use in China with another ten or more brands looking to enter the market very soon. The rapid growth of the cellular market is also attracting Chinese radio and electronics equipment factories' interest in starting production of cellular terminals. Only one Chinese brand, Panda, has emerged so far.

Motorola was the first foreign brand to set up manufacturing arrangements to produce cellular terminals in China for the domestic market. China's large potential GSM terminal market also seems likely to be supplied by locally made as well as imported handsets. Companies planing to make GSM terminals in China in future including Ericsson, Alcatel and Siemens.

Ericsson

Ericsson launched its GH 337 GSM handphone in mid 1994. Also, the EH 237 ETACS handportable which has been available in China since the beginning of 1994 plus the AH 237 dual mode AMPS/D-AMPS model. Ericsson is looking to build its CMT business to account for 15% to 20% of the China market. As part of plans to develope handportables sales Ericsson plans to set up a joint venture company to make cellular terminals for distribution throughout China and act as a technical service centre.

Motorola

Motorola controls an estimated 80% share of the China market supplying mainly handportables. The company has dominated the subscriber handset market from the beginning by being the first company to seriously address this potentially huge market and by ensuring a range of popular models is available to subscribers in almost all of China's 30 provinces. Motorola has built up its market leader position supplying TACS terminals, and now is supplying an increasing number of AMPS operators as networks are launched. Although Motorola aims to remain the leading CMT brand in

China, the company expects its market share to reduce in the longer terms as more new brands begin developing sales. The company supplies PTAs throughout China through about 20 distributors which include Hong Kong-based companies as well as Chinese government corporations. These distributors cover about 80% of customers in China. Although local production is being expanded in China, a large number of terminals still are produced in UK for the China market. Besides the licensing agreement in Hangzhou Communication Factory, Motorola started up production in March 1994 in its own factory in Tianjin.

NEC

NEC is the third largest cellular terminal supplier to China with an estimated 6% cumulative market share. So far NEC has supplied cellular terminals both as part of complete cellular system and terminal turnkey contract and also terminal as separate orders. NEC's cellular terminal sales to China are handled by NEC Hong Kong through four offices in China run as liaison offices by NEC corporation of Japan. The offices are located in Beijing, Shanghai, Guangzhou and Shenzhen. NEC has three joint venture companies in China. One in Tianjin makes digital telephone exchanges, one in Wuhan in Hubei Province makes optical fibre terminals and another joint venture in Beijing makes integrated circuits.

Nokia

Since early 1994 Nokia has been working on developing a new marketing and distribution plan for China, supported by additional sales and marketing staff. The

company is now looking to establish joint venture handset production facilities in China to further develop sales in future. In 1993 Nokia overtook NEC to become the second largest TACS terminal supplier to China gaining an estimated 10% cumulative market share. The company received orders for about 100,000 TACS terminals in 1993, half of those ordered by PTAs in Guangdong.

Hong Kong

There were a very much depleted number of analogue terminals available on the Hong Kong market in mid-93. However, in 1994, the major market shift from analogue to digital mainly GSM and TDMA. And only three digital brands are competing in the market, namely Motorola, Ericsson and Nokia. Counting as well the share of parallel importing products, Motorola receives a 85% market share while Ericsson and Nokia maintain a 8% and 7% market share respectively.

Motorola

Motorola Hong Kong is a liaison office that distributes the cellular phones only to cellular operators who in turn market the products to final endusers through their distribution channels. To control the parallel imported products, Motorola is considering to appoint independent distributors to target the low end segment which the existing operators are unable to penetrate.

Ericsson

Besides supplying to operators, Ericsson has a distributor to market her products to various channels as well as to China. Ericsson is putting major emphasis to promote her GSM products in Hong Kong which have traditional influence to the huge China market.

Nokia

Nokia Hong Kong keeps a direct buy and sell operation to maintain fast response to market requirement. Nokia is also using the Hong Kong market to influence the China business.

Product Comparisons

The comparisons of various famous analogue cellular terminals are shown in Exhibit 17, while that of digital cellular terminals are shown in Exhibit 18.

Market shares

PRC

Motorola is the top selling brand in China. Nokia and NEC are the two other popular brands. Motorola is estimated to have supplied about 80% of the total cumulative Chinese terminal market to date (Exhibit 19 and 20). Although Motorola aims to maintain its dominant position in future, the company's actual market share is likely to decrease as more brands establish themselves in the market. Eventually

Motorola expects to control about 50% to 60% of the cellular terminal market. Other brands are looking to establish an important presence in future including the various joint ventures setting up to make TACS products, plus European GSM terminals manufacturers. One company making a determined effort is Ericsson which has supplied much of China's infrastructure but which until the end of 1993 did not have the right terminal product to make any headway into the cellular terminal market. Meanwhile, cellular terminal makers are keeping a close eye on other terminal sales opportunities that are expected to arise shortly as China implements various other cellular standards. Most leading GSM terminal suppliers are preparing to compete for the orders expected in 1995 as MPT and China Unicom begin commissioning GSM networks. China's AMPS terminal market also will create more interest as the number of private AMPS system subscriber grows.

Hong Kong

Of the total 420,000 cellular terminals in use in Hong Kong at the end of 1994, 95% are portables. Motorola continues to dominate the market with around 65% share, followed by NEC, Ericsson and Nokia. However, in 1993 and 1994, NEC are losing her market share tremendously to Motorola, Ericsson and Nokia as NEC does not have any digital products in GSM and TDMA systems. All three suppliers are selling their own brands as well as the OEM brands. They are Bosch of Motorola, Blaupunkt of Ericsson and Technophone of Nokia (Exhibit 21).

Price Trend

PRC

Cellular terminal prices dropped by about 30% throughout China during the third quarter of 1994 following the pressure from MPT on PTA operators due to official concern that terminal prices have been relatively much higher than other consumer products in China. MPT approved prices are understood to have dropped in all provinces though there is still some variation between what PTA charges its subscribers. This terminal price cut also is designed to help PTA operators become more competitive when Unicom launches its GSM networks as TACS terminal prices will affect GSM terminal price levels offered by MPT and Unicom.

Until the recent cellular price drop, terminal prices simply reflected PTA's present network operator monopoly position. In relative terms China's cellular terminal prices are still some of the highest in the world and this is no doubt partly responsible for the creation of the black market in terminals. Cellular prices are decided by the city PTA operator in agreement with the provincial PTA to ensure uniformity in prices across the province. As China still has to see a terminal replacement market develop, most PTAs quote their terminal prices inclusive of the initial network connection fee that now averages Yuan 5,000. Since the recent prices cutting the lowest terminal prices appear to be about Yuan 6,500 which added to the connection fee indicates a quoted cellular terminal cost of Yuan 11,500.

In spite of the price reductions most PTAs still price all of their terminal selection at the same price or divide models into two price bands - the subscriber choosing according to technical preferences rather than cost. Actual price levels are decided according to what profit margin is required and by preference to the purchase price of the cellular terminal.

Hong Kong

SmarTone's launch of GSM network had changed the price trend of cellular terminal. SmarTone's strategy is to provide a relatively low price handset and network tariff. In addition, Pacific Link is unable to move her TDMA handset and thus reducing the price to stimulate sales. Nevertheless, the major driving force for the general reduction in handset prices in last 18 months. Handset prices in general have dropped over 50% in 1994 and this further expand the market size and stimulate the demand.

Competition from CT2

PRC

CT2 was targeting the niche market to complement the cellular operation when

- the demand far exceed the supply and it takes over 12 months to get a cellular phone;
- the traffic was so bad that the cellular phone was hard to get incoming call and
- the cellular handset price is too high to afford.

However, CT2 is difficult to expand further the business as it requires many cells to maintain a broad coverage. In addition, mature CT2 users are aiming for better service and thus migrating to cellular. Currently, CT2 operation is only confined in limited cities including Shenzhen and is unable to further expand.

Hong Kong

In March 1991, OFTA issued four CT2 licenses to:

- Hutchison Paging
- Chevalier Telepoint
- Hong Kong Callpoint
- Pacific TeleLink

With the launch of Hutchison and Chevalier operation, the subscriber base has been growing at an average monthly rate of almost 5,000 per month, however, similar number of subscriber are losing making the cumulative subscribers less than 100,000. This is because the initial positioning of "poor man cellular" has set a wrong perception to customers who found that both the operation and coverage are much falling behind the cellular operation.

Pacific TeleLink refined the CT2 operation and positioned it as "phone booth" has stimulated the CT2 demand. Following the cut throat price competition, it attracts a group of youngsters to subscribe and the subscriber base grows to 180,000. However, CT2 is never a real competition to cellular as it cannot offer a "continuous"

communication which a mature CT2 user will look for. Instead CT2 educates the youngsters for wireless communication and provides a potential customer base for cellular.

CHAPTER VI

TECHNOLOGY

Technology shapes people's life. It also affects the economic growth rate and the product life cycle. Unable to watch and match technological trend will be disastrous to operation.

Migration to Digital Era

PRC

Since Hong Kong cellular operators began to implement digital cellular systems in 1992 China has begun to take a strong interest in developing digital cellular systems in most leading provinces. Installing digital cellular systems will allow the present roaming arrangement with Hong Kong to continue in future providing an important source of foreign exchange revenue for those Chinese provinces and cities attracting a high number of Hong Kong cellular subscriber businessmen. With cellular subscriber figure rising rapidly each year China's interest in digital cellular technology increasingly is focused on providing sufficient capacity to support large subscriber number in future and less with simply installing state-of-the-art technology for its own sake. At present

China has still to decide its digital standards after originally appearing to have chosen GSM.

GSM

Although no official announcement has been made GSM seems to be the de facto national digital standard. Newly formed China Unicom has been given 6 MHz of the GSM band and is planning a rapidly network installation program. MPT, facing competition for the first time, is following suit by preparing to deploy GSM networks in all the major provinces during 1995.

CDMA

With the result of the joint MPT-Qualcomm three months CDMA trial in Tianjin which ended in June 1994 recently announced, many industry observers believe that China may be about to adopt more than one digital cellular standard for the 900 MHz band. It seems that MPT's primary interest is rolling out GSM networks for the moment with CDMA likely to be employed as a second generation digital technology.

Hong Kong

Hong Kong has started her transition to digital since 1992, the three existing analogue cellular operators are invited to convert their analogue systems to digital and SmarTone has received a GSM license. The digital plan is as follows:

- Hong Kong Telecom CSL converted its TACS network to GSM since August 1993 and will occupy 7.5 MHz x 2 of spectrum eventually.

- Pacific Link has converted its ETACS network into D-AMPS following the IS-54 standard since October 1992 and will eventually occupy 7.5 MHz x 2 of spectrum by June 1996.
- Hutchison will convert its TACS network into a GSM system and its AMPS network into CDMA with 7.5 MHz x 2 available ultimately for each system.
- SmarTone has launched its GSM network in January 1993 and will eventually occupy 7.5 MHz x 2 by June 1997.

In addition to above, OFTA will issue 6 PCN (Personal Communication Systems) licenses and 4 CAS (Cordless Access Systems) license by end 1995. This will further stimulate the relinquishment of the existing analogue networks.

New Generation on Mobile Terminal

PRC

Cellular in China is still in a developing stage and the users are not too concern on value-added features such as data capability. The requirement is still primitive to make incoming and outgoing calls. However, in a global prospective, it is not economical to make a special model to fit the China and thus most suppliers are offering standard products in China market. One exception will be the Chinese character display. Most handset manufacturers are aiming to be the first supplier to offer this. Nevertheless, the technology trend is to offer smaller size and lighter weight handsets as IC technology continue to advance.

Hong Kong

Hong Kong has ten years history in cellular operation and customers are much more mature to demand value-added features. With the migration to digital technologies, numerous data related functions (fax, data transmission etc.) will be offered by operators and these put stringent requirements in cellular terminals. Manufacturers are looking for smaller size, lighter weight handsets but can accommodate more features. This will reply only on further advancement in IC technology.

CHAPTER VII

ECONOMIC ENVIRONMENT

The economic environment consists of factors that affect the consumer's purchasing power and spending pattern. Companies should be aware of major trends in income and changing consumer spending pattern which is vital in setting marketing plan.

PRC

Starting late 1978 and early 1979 Mr. Deng Xiao Ping began his famous economic reforms which were extremely successful in most sectors. By 1987 and 1988 the reforms really accelerated and spread across the country. The reforms especially price reforms brought along inflation, an unheard of phenomenon in communist countries. By 1987-88 China experienced an inflation rate close to 20% and the economy was overheated. Market reforms also brought about wide-spread corruption among government officials. By end 1989, reforms came to a full stop immediately follow the Beijing event, foreign loans were withdrawn and foreign companies (except the Japanese) retreated. For the next two years, 1990 and 1991 there were no more reforms, GNP growth are planned and restricted to 6% annually by Premier Li Peng and his austerity plan.

In January 1992, Deng went on his Southern tour to restart his reforms program, and demanded bolder and faster steps in reforms (10% to 12% growth instead of 6%) and emphasised on market economy and socialist market economy. China's economic structure is maturing, with continue shifts in output and labour-force shares from agriculture to industry and services, and the most rapid growth continues to be outside the state-owned sector. Now, the private sector accounts for more than 30% of GNP.

The most likely evolutionary path for Chinese economic institutions is a gradual, deliberate and managed success of economic reforms. Market and market prices will continue to spread in all dimensions of the economy, as labour-contract reforms mature and spread, enterprise ownership scheme in industry and other sector will diversify in the direction of stock companies with an initial high share of government participation. The development of stock markets in China is a first step in this direction. The share holding system is considered to be the best option because it can clearly define the property rights of the companies and enable them to change their style of management. It can also help the companies raise funds from the public.

In many ways managed success in China is very similar to other authoritarian quasi-market economies e.g. Taiwan, South Korea, and early Japan which directly and indirectly managed domestic investment, banks, financial markets, foreign exchange, foreign trade, foreign investment, industrial policy, and labour markets. Access to foreign markets and foreign exchange earning will significantly increase the chance of reform success. Access to adequate foreign exchange will allow import of critical

bottleneck materials e.g. refined fuel, and technology required to develop China's infrastructure and export-oriented industries. China's economic success promises enormous benefits to other East Asian economies and for the US and Western, as it will offer a stable environment for foreign investment, Chinese co-operation in multilateral trade talks, and the largest potential market for US high-tech and knowledge intensive exports.

Hong Kong

The Hong Kong economy maintained a steady growth in 1994. Consumer spending continued to register solid increases. Investment in building and construction strengthened, supported by the acceleration in activity in the pubic sector. In line with the steady economic growth, labour resources continued to shift from manufacturing to the services sector, induced by the on-going structural transformation of Hong Kong into a more service-oriented economy.

Since the adoption of 'open door' policies by China in late 1978, Hong Kong's economic relations with China have undergone paid growth and development. The two are each other's major trading partners. China has been investing heavily in Hong Kong. Its investment ranges from traditional activities such as banking, importing and exporting, wholesaling and retailing, and transportation and warehousing to newer areas such as property development, provision of financial services, manufacturing and involvement in infrastructure projects.

Owing to its small size and open nature, the economy is vulnerable to external factors, and government actions designed to offset unfavourable external influences are of limited effectiveness. Moreover, the government considers that, except where social considerations are over-riding, the allocation of resources in the economy is best left to market forces, with minimal government intervention in the private sector. This basically free-enterprise, market disciplined system has continued to contribute to Hong Kong's economic success. A relatively simple tax structure, with low tax rates, provide a good incentive for workers to work and for entrepreneurs to invest. Both workers and entrepreneurs are motivated. The primary role of the government is to provide the necessary infrastructure and a sound legal and administrative framework conductive to economic growth and prosperity.

CHAPTER VIII

LEGAL ENVIRONMENT

PRC

Migration into Deregulated Environment

Decentralisation of MPT's authority over the market will be the basis for the gradual deregulation of China's telecom industry. But while the formation of a second network through the establishment of Ji Tong and China Unicom will create more opportunities for foreign firms, their authority is not yet clear. Tied to China's internal political developments, their impact on the telecommunications market is not yet predictable.

Of necessity, most foreign telecom companies have a working relationship with the MPT. And despite its current regulatory policies, greater opportunities for foreign investment are emerging daily in China's drive to meet its telecom goals.

The choice between a front door approach through the MPT and backdoor investment routes through provincial and city telecom authorities is primarily strategic,

involving immediate market access and positioning for later developments in a rapidly expanding market.

While direct equity investment and operation remains an eventual goal of foreign participation in the telecom market, companies that will take advantage of those options when they are introduced will be those already committed to joint venture manufacturing and other supply service agreements exploiting the limits of China's current foreign investment policy.

While developments of wireless telecommunications at the city and provincial levels may offer the most immediate results, China's need for foreign investment and expertise to accomplish its goals by the year 2000 means measures will be taken to accommodate foreign involvement within the next several years.

Demand today in China's telecom market has reached an unprecedented level. Combined with the fluidity of the regulatory environment, opportunities to satisfy both immediate and longer-term objectives in this market are now becoming primary.

With annual spending on telecom infrastructure expected to near US$8 billion, China's market reforms will find a way to embrace more direct foreign participation, if not with open arms, then in the oblique manner observers have become accustomed to.

According to the announcement from China Unicom, there are three reasons for the introduction of the second telecommunications network:

1. There is a great difference between the demand and supply of telecommunications market. By introducing a competition mechanism, telecommunications infrastructure can be developed much more rapidly.

2. There are some fully developed private telecommunications networks established in China and their networks are not fully utilitised.

3. The development of telecommunications infrastructure required a huge amount of capital. It cannot and should not be totally responsible by the government. But under the monopoly of MPT, the eagerness of all other network operators to invest and to co-ordinate the overall development is not high.

Government Policy

In order to prevent too intensive competition and interference of frequency used, MPT is still not allowing foreign companies to invest directly or indirectly into the operation of telecommunications networks.

However, foreign investors can form joint venture type of co-operation, in which investment in capital or equipment is allowed but control of share and management of operation are not allowed. Profit can be got back in the same proportion of the investment ratio. There most be a definite period of co-operation stated in the co-operation contract, after which the operation and management of the network will be transferred to the China party.

Import tax and import license are the tools used by the Chinese government to control the extends of economic development. In the late 1993, the import license control was tightened so as to control the intensive import of expensive mobile phones into China. In early 1994, 17% VAT tax was imposed on most of the telecommunications products so as to suppress the illegal import of equipment.

Difficulties Encountered in Deregulation

During the early development stage of China Unicom and the others, there are three major difficulties faced with:

Co-operation with MPT

Someone may think that the first and second network are working independently, but in fact is not. The two networks are linked together otherwise the users in different networks cannot be communicated. There is a common problem faced with in world-wide is that the new and the old network needed to be co-operated, and the new network requires the support of the old network in order to survive. Hong Kong is an example, the DGT spent a lot of time in the negotiation with HK Telecom to provide connection to the three second network operators Hutchison, Wharf and New World.

In China, as MPT is responsible for both the setting up and monitoring of regulations, if China Unicom want to have full co-operation from MPT, they can only

get from the special functional group under the State Council with someone like vice-minister as judgement.

Besides the support from the central government, China Unicom also need to get support from each provincial PTA. Because some province like Guangdong, has quite large degree of freedom in authority, the support from these provinces cannot be neglected.

Personnel and management

In the past, those profession personnel in telecommunications field was mainly found in MPT. Although Ministry of Electronic Industry, Ministry of Energy and Ministry of Railway have their own professionals, the management of private network and public network would be a great difference, therefore Unicom need to spend a lot of time and money on the training up of people.

Training by foreign companies would be a possible solution, however, as the central government and MPT do not allow the involvement and management by foreigners, this solution cannot be implemented.

Shortage of capital

Shortage of capital seems to be the least serious problem out of the three major difficulties. Although the overall investment in the second network is large, it can be implemented in different phases. Besides, all the existing private networks will be used

and once the private networks are connected to the MPT networks, they can start to receive customers. The initial profit can then be re-invested into the second phase development.

In view of the present economic development, if the services of the second network is satisfactory and the price is competitive, import will not be the largest problem.

In addition, due to the keen competitions in the market, many suppliers of infrastructures and handsets will offer credit on payment, soft loan and to provide source of funds from different banks.

In conclusion, the formation of China Unicom is good in opening up the market. The next importance question is the role played by MPT. How MPT to separate the thinking of monitoring from doing business is the key issue.

Hong Kong

The legal system in Hong Kong is firmly based on the rule of law and the independence of the judiciary. The Sino-British Joint Declaration on the Question of Hong Kong and the Basic Law of the Hong Kong Special Administration Region of the People's Republic of China provide that the present judicial system will be maintained after 1997, except for those changes consequent upon the establishment of the Court of Final Appeal (CFA).

Law in Hong Kong

The law of Hong Kong generally follows that of England. The application of English Law Ordinance declares the extent to which English law is in force in the territory. The ordinance provides that the common law of England and the rules of equity shall be a force in the territory so far as they are applicable to the circumstances of Hong Kong or its inhabitants, subject to such modifications as circumstances may require.

Telecom Deregulation

On 1 July, 93, after a recommendation in December 92 by the Economics Services Branch, a new regulatory authority for telecommunications in the territory was created. OFTA, the Office of Telecommunications Authority is responsible for all aspects of telecommunications policy. The Postmaster General will no longer act as the Telecommunication Authority and the new Director General, Alex Arena, is on board. The equipment supply market in Hong Kong was fully deregulated on 17 May, 1990. However, for the import and sale of radio equipment, suppliers have had to apply for import permits or a Radio Dealer License. All units must conform to FCC, DTI/BABT or DOC (Canada) if they are to be sold in Hong Kong. All public non-exclusive services not using radio are licensed under PNETS licenses. Public non-exclusive services using radio are licensed under PRS licenses with the exception of public radio paging services and public radio communication licensees established before December 1990.

In 1991 HKPO backtracked from its original concession to allow the network operators to approve and type-test equipment for use on their networks. Since then the HKPO has referred all parties to HOKLAS, the Hong Kong Laboratory Accreditation Scheme to determine whether their type testing facilities in Hong Kong or overseas are acceptable. Hong Kong Telecom offers a voluntary Network Compatibility Check (NCC) procedure and encourages vendors of Customer Premises Equipment to apply for certification, but permission to connect is not mandatory.

Mobile Telecommunications Service

There are four licensed Public Radiotelephone Service (PMRS) operators (i.e. cellular radio), four licensed Telepoint (CT-2) Service Operators, and more than 30 radio paging operators. While market demand for mobile services continue to grow, spectrum constraints have limited the scope for expanding existing analogue cellular systems. The transition to digital cellular technology is being undertaken to alleviate these analogue supply-side constraints. However, the growth in the supply of capacity through digital cellular technologies has not met expectations, and the overall consumer demand for mobile services has not been satisfied. At the same time, there has been continued development in technology for the provision of new and innovative mobile service technologies, for example, as in "Personal Communications Networks" (PCN) concepts. Essentially, PCN services refer to the ability to provide personal and portable telephone services with a greater degree of functional flexibility than current mobile or fixed services, either in conjunction with those services or as a substitute for them. For Hong Kong these new technologies can be seen as a natural evolution of existing services and offer two potential benefits: first, extra capacity because new

spectrum at higher frequency bands can be utilised and second, the available spectrum creates scope for licensing new entrants to compete with the existing operators.

While the existing regulatory arrangements have served Hong Kong well, the Telecommunications Authority (OFTA) has formed the view that it would be prudent to review the regulation of mobile services in Hong Kong given the market and technological development taking place. The review is intended to develop and implement the framework best suited to future development of this important sector of Hong Kong's telecommunication industry.

CHAPTER IX

RECOMMENDATIONS FOR A NEW ENTRANT INTO THE MARKET

As a conclusion, the following is the summary of those experiences a new entrant could be considered, in addition to the studies of the macro- and micro-environment in the previous chapters. We can find that in a regulated and deregulated market, the method and difficulties in the two different markets actually differ a lot. Even though China is now migrating to a deregulated environment, it still has a long way to go and at the time being, to enter the China market is much more difficult than that to Hong Kong. However, as China is the largest potential market for cellular equipment in East Asia, it is worthwhile to spend more money and time in developing the China market.

PRC

Type Approval

In the regulated telecommunication market in China, the sales of mobile communication equipment is under strictly control. Type approval is one of the means to restrict which brand can be allowed to sell into China. According to the regulation under MPT, mobile bureaux can only purchase type-approved cellular terminals with

Permission To Connect (PTC) sticker sticked on it. This regulation is strictly enforced in 1995. Type approval can be said as one of the most critical and essential steps in the launching of a new cellular phone in China. Failure to get type approval certificate makes the subsequent sales extremely difficult.

The formal procedures to apply for type approval is to apply to the Administrative Bureau of MPT. The applicant must be either a manufacturer or a local distributor. The applicant will be asked to submit a few samples to the Transmission Centre under the MPT for type approval test. The test is mainly to test the technical performance and specifications of the cellular phones. Laboratory test is the basic part, and sometimes a field test is added. A test report will be issued upon the completion of the test. This report will be returned to the applicant and a copy will be sent to the Administrative Bureau. If the test is pass, the Administrative Bureau will arrange an interview with the applicant mainly to (1) demonstrate the product, (2) explain the technical questions like circuitry design, ESN security etc., (3) the maintenance support and sometimes (4) the distribution strategy. If interview is pass, MPT will internally record the brand as type-approved. At this time, the first stage is finished.

If the manufacturer does not have a local production factory in China, the type approval certificate will only be given in sales volume basis. For each shipment of a fixed quantity, you need to apply for the corresponding type-approval certificate from the Administrative Bureau. Import license and custom clearance certificate are required to submit together with the application. A certain percentage of good will be sampled for test, upon passing the test, the Administrative Bureau will issue a type-

approved letter stating the PTC sticker serial numbers and PTC stickers of the same quantity will be issued to the applicant.

The most important criteria as whether you can get a type approval certificate is whether you can get a right channel. In the typical Chinese business culture, that is to say whether you can have the "Guan Xi" or "relationship". Therefore, it is more appropriate to find a local dealer with strong relationship with the Administrative Bureau to ensure that the application is successful.

Import

Import by smuggling or illegal channels are not recommended due to high risk. As the transaction is usually high, the high risk is not justified. In addition, import license and custom clearance documents are unable to obtain using these channels, and hence using these channels, type approval certificates cannot be obtained.

Import by proper channel through custom and with import license enables the application for type approval label. It is believed that it was a common practice to declare a lower equipment price so as to lower the import tax. In the highly competitive market, whether you can get the most reliable and cheapest import channel is the major factor that allow you to price your product competitively.

Distribution

Distribution strategy can be mainly divided into direct sales and dealer sales categories. Distribution through distributor and dealer network can allow you to move more rapidly into the market, and at the same time, the dealer can help you to arrange the type approval procedures. However, selling through dealers will either lower your profit margin or increase the selling price. The financial background of the dealer must be taken into consideration. Dealers with weak financial background usually will not keep stock, and will usually pay you back the money after they have shipped the goods and received payment from the enduser.

Direct selling into mobile bureaux is more effective. However, this will require higher investment at the beginning. Local staff and offices are required to facilitate the penetration.

Pricing

Pricing is the most importance factor whether a user will buy your product or not. As a rule of thumb, your product should not be higher in price than the most popular model - Motorola 9900 at the time being. Higher in price will make your sales quantity exponentially decrease. As Motorola had established its goodwill, confidence, good maintenance services and vase availability of accessories, even though your product is better than that of Motorola, sometimes you can only sell at the same price of it. As Motorola had enjoyed the economies of scale much earlier than other

competitors and had set up a large entry price barrier to the followers, competitive pricing should be ready before you really want to enter into the market.

Local Production

There are two types of local production mostly found in China. The first type is a nominal type of production, in which no real production is actually being done. The use this joint venture factory is only as a mean to obtain cheaper import tax and to get type approval certificate more easier. However, this type of virtual production actually does not give too much benefits. Many factories of this type had eventually lost their competitive edge, as import tax is not differ too much from special channel import charge.

The second type is real local production, by means of SKD and CKD types of production and finally go into local sourcing of components. The real production can give you actually lower in manufacturing costs due the lower labour wages and components. However management is usually complicated and scrap rate is high in China. To form a local production factory is usually a long term goal as one really want to lower the production costs, rather than a short term strategy to use it as a tool to import and to get the type-approval certificate. Therefore, before the real production can be considered, a significant customer base and a good sales record must first be developed.

Hong Kong

Compare to China, the entry to the Hong Kong market is much more simpler. This can be seen from the figures of market share as we had previously discussed. 30% of the Hong Kong market is shared by brands other than the best seller Motorola. Whereas in China, Motorola had got a 80% market share.

Type approval is also the first step to do but this is just a step you need to do before you sell, and good equipment can always get the certificate. Application should be submitted to Office of Telecommunications Authority, upon passing the test, a Approval Certificate will be issued.

Free market strategy can be applied, and success of the entry depends more on your product, pricing and promotion strategy.

EXHIBIT 1

SYSTEM SUMMARY TABLE - MPT NETWORKS

Province	Supplier	Technology	Opened
Beijing	Ericsson	TACS	1990
	Motorola	TACS	1987
	Nokia	GSM	1994
	Motorola	GSM	1994
Shanghai	Ericsson	TACS	1990
	Motorola	TACS	1987
	Siemens	GSM	1994
Tianjin	Ericsson	TACS	1990
	Motorola	TACS	1993
	Motorola	GSM	1995
Tanggu	Motorola	TACS	1993
Tianjin	Qualcomm	CDMA *	1994
Anhui			
Hefei	Motorola	TACS	1993
Bengbu	Motorola	TACS	1993
Wuhu	Motorola	TACS	1993
Anqing	Motorola	TACS	1993
Chuzhou	Motorola	TACS	1993
Fuyang	Motorola	TACS	1993
Tunxi	Motorola	TACS	1993
Suzhou	Motorola	TACS	1994
Fujian	Motorola	TACS	1990
Fuzhou	Motorola	TACS	1990
Xiamen	Motorola	TACS	1993
Longyan	Motorola	TACS	1993
Nanping	Motorola	TACS	1993
Quanzhou	Motorola	TACS	1993
Putian	Motorola	TACS	1993
Zhangzhou	Motorola	TACS	1993
Sangming	Motorola	TACS	1993
Ningde	Motorola	TACS	1993
Gansu	Motorola	TACS	1993
Lanzhou	Motorola	TACS	1993
Tianshui	Motorola	TACS	1993
Jiuquan	Motorola	TACS	1994

*Trial system

Province	Supplier	Technology	Opened
Guangdong			
Foshan	Ericsson	TACS	1992
Guangzhou	Ericsson	TACS	1987
Guangzhou	Ericsson	GSM	1994
Huizhou	Ericsson	TACS	1992
Huizhou	Nortel	GSM	1994
Jiangmen	Ericsson	TACS	1992
Meizhou	Ericsson	TACS	1994
Shantou	Ericsson	TACS	1991
Shantou	Ericsson	GSM	1994
Shaoguan	Ericsson	TACS	1993
Shenzhen	Ericsson	TACS	1988
Shenzhen	Siemens	GSM	1994
Zhanjiang	Ericsson	TACS	1992
Zhaoqing	Ericsson	TACS	1993
Zhuhai	Ericsson	TACS	1988
Zhuhai	Italtel	GSM	1994
Zhuhai *	Motorola	GSM	1994
Dongguan	Ericsson	TACS	1995
Zhongshan	Ericsson	TACS	1995
Qingyuan	Ericsson	TACS	1995
Chaozhou	Ericsson	TACS	1995
Jieyang	Ericsson	TACS	1995
Maoming	Ericsson	TACS	1995
Yangjiang	Ericsson	TACS	1995
Shunde	Ericsson	TACS	1995
Nanhai	Ericsson	TACS	1995
Shanwei	Ericsson	TACS	1995
Heyuan	Ericsson	TACS	1995
Guangxi			
Beihai	Ericsson	TACS	1992
Guilin	Ericsson	TACS	1992
Liuzhou	Ericsson	TACS	1992
Nanning	Ericsson	TACS	1992
Qingzhou	Ericsson	TACS	1992
Wuzhou	Ericsson	TACS	1992
Yulin	Ericsson	TACS	1992
Fanchanggang	Ericsson	TACS	1993
Hechi	Ericsson	TACS	1993
Baiso	Ericsson	TACS	1993
Guizhou			
Guiyang	Motorola	TACS	1993
Duyun	Motorola	TACS	1993
Zunyi	Motorola	TACS	1993
Hainan			
Haikou	Ericsson	TACS	1991
Haikou	Italtel	GSM	1995
Sanya	Ericsson	TACS	1992

* Not PTA, but private system run by local Zhuhai government

Province	Supplier	Technology	Opened
Hebei			
Baoding	Ericsson	TACS	1992
Cangzhou	Ericsson	TACS	1993
Chengde	Ericsson	TACS	1993
Handan	Ericsson	TACS	1992
Hengshui	Ericsson	TACS	1993
Langfang	Ericsson	TACS	1992
Qinhuangdaoa	Ericsson	TACS	1987
Shijiazhuang	Ericsson	TACS	1991
Tangshan	Ericsson	TACS	1992
Xingtai	Ericsson	TACS	1993
Zhangjiakou	Ericsson	TACS	1993
Heilongjiang			
Harbin	Motorola	TACS	1992
harbin	Ericsson	TACS	1994
daqing	Motorola	TACS	1993
Hegang	Motorola	TACS	1993
Heihe	Motorola	TACS	1993
Jiagedaji	Motorola	TACS	1993
Jiamusi	Motorola	TACS	1993
Jixi	Motorola	TACS	1993
Mundanjiang	Motorola	TACS	1993
Qiqihar	Motorola	TACS	1993
Qitaihe	Motorola	TACS	1993
Shihua	Motorola	TACS	1993
Shuangyashan	Motorola	TACS	1993
Yichun	Motorola	TACS	1993
Hebi	Motorola	TACS	1994
Oil fields:			
* Daqing	Nokia	NMT-450	1988
* Liao He	Nokia	NMT-450	1989
Henan			
Zhengzhou	Motorola	TACS	1991
Luoyang	Motorola	TACS	1992
Anyang	Motorola	TACS	1993
Jiaozuo	Motorola	TACS	1993
Kaifeng	Motorola	TACS	1993
Luohe	Motorola	TACS	1993
Nanyang	Motorola	TACS	1993
Pingdingshan	Motorola	TACS	1993
Sanmenxia	Motorola	TACS	1993
Shangqui	Motorola	TACS	1993
Xinxiang	Motorola	TACS	1993
Xinyang	Motorola	TACS	1993

* Oil field systems are private, not PTA

Province	Supplier	Technology	Opened
Hubei			
Wuhan	Motorola	TACS	1992
Enshi	Motorola	TACS	1993
Ezhou	Motorola	TACS	1993
Huanggang	Motorola	TACS	1993
Huangshi	Motorola	TACS	1993
Jingzhou	Motorola	TACS	1993
Shiyan	Motorola	TACS	1993
Xiangfan	Motorola	TACS	1993
Xianning	Motorola	TACS	1993
Xiaogan	Motorola	TACS	1993
Yichang	Motorola	TACS	1993
Hunan			
Changde	Ericsson	TACS	1993
Changsha	Ericsson	TACS	1992
Chenzhou	Ericsson	TACS	1993
Hengyang	Ericsson	TACS	1993
Huaihua	Ericsson	TACS	1994
Jishou	Ericsson	TACS	1994
Loudi	Ericsson	TACS	1993
Shaoyang	Ericsson	TACS	1993
Xiangtan	Ericsson	TACS	1993
Yiyang	Ericsson	TACS	1993
Yueyang	Ericsson	TACS	1993
Zhuzhou	Ericsson	TACS	1993
Inner Mongolia			
Baotou	Ericsson	TACS	1993
Hothot	Ericsson	TACS	1991
Wuhai	Ericsson	TACS	1993
Hailar	Ericsson	TACS	1993
Chifeng	Ericsson	TACS	1993
Ganzhouli	Motorola	TACS	1994
Jiangsu			
Nanjing	Ericsson	TACS	1993
Nanjing	Motorola	TACS	1993
Wuxi	Ericsson	TACS	1993
Wuxi	Motorola	TACS	1993
Suzhou	Motorola	TACS	1993
Xuzhou	Motorola	TACS	1993
Lianyungang	Motorola	TACS	1993
Changhou	Motorola	TACS	1993
Huaiyin	Motorola	TACS	1993
Nantong	Motorola	TACS	1993
Yancheng	Motorola	TACS	1993
Yangzhou	Motorola	TACS	1993
Zhengjiang	Motorola	TACS	1993

Province	Supplier	Technology	Opened
Jiangxi			
Nanchang	Motorola	TACS	1993
Jiujiang	Motorola	TACS	1993
Xinyu	Motorola	TACS	1993
Yichun	Motorola	TACS	1993
Yingtan	Motorola	TACS	1993
Jian	Motorola	TACS	1994
Jingdezhen	Motorola	TACS	1994
Fuzhou	Motorola	TACS	1994
Mingzhou	Motorola	TACS	1994
Pingxiang	Motorola	TACS	1994
Shangrao	Motorola	TACS	1994
Jilin			
Changchun	Motorola	TACS	1993
Yanji	Motorola	TACS	1993
Jilin city	Motorola	TACS	1993
Siping	Motorola	TACS	1994
Tonghua	Motorola	TACS	1994
Songyuan	Motorola	TACS	1994
Liaoning			
Shenyang	NEC	TACS	1989
Shenyang	Ericsson	TACS	1994
Shenyang	Motorola	TACS	1995
Dalian	NEC	TACS	1990
Dalian	Ericsson	TACS	1994
Dalian	Motorola	TACS	1994
Liaoyang	Ericsson	TACS	1994
Liaoyang	Motorola	TACS	1995
Jinzhou	Ericsson	TACS	1994
Jinzhou	Motorola	TACS	1995
Anshan	Ericsson	TACS	1994
Anshan	Motorola	TACS	1995
Benxi	Ericsson	TACS	1994
Benxi	Motorola	TACS	1995
Jinxi	Ericsson	TACS	1994
Jinxi	Motorola	TACS	1995
Fushun	Ericsson	TACS	1994
Fushun	Motorola	TACS	1995
Tieling	Ericsson	TACS	1994
Tieling	Motorola	TACS	1995
Chaoyang	Ericsson	TACS	1994
Chaoyang	Motorola	TACS	1995
Panjin	Ericsson	TACS	1994
Panjin	Motorola	TACS	1995
Fuxin	Ericsson	TACS	1994
Fuxin	Motorola	TACS	1995
Dandong	Ericsson	TACS	1994
Dandong	Motorola	TACS	1995
Yingkou	Ericsson	TACS	1994
Yingkou	Motorola	TACS	1994

Province	Supplier	Technology	Opened
Ningxia			
Yinchuan	AT&T	AMPS	1993
Qinghai			
Xining	Ericsson	TACS	1993
Shaanxi			
Xian	AT&T	AMPS	1993
Xian	Motorola	TACS	1993
Longshou	Motorola	TACS	1993
Hemashi	Motorola	TACS	1994
Shandong			
Jinan	Motorola	TACS	1990
Qingdao	Motorola	TACS	1992
Dezhou	Motorola	TACS	1993
Jining	Motorola	TACS	1993
Weifang	Motorola	TACS	1993
Weihai	Motorola	TACS	1993
Yantai	Motorola	TACS	1993
Bingzhou	Motorola	TACS	1993
Heze	Motorola	TACS	1993
Linyi	Motorola	TACS	1993
Taian	Motorola	TACS	1993
Zibo	Motorola	TACS	1993
Rizhao	Motorola	TACS	1994
Laochang	Motorola	TACS	1994
Dongying	Motorola	TACS	1994
Zaozhuang	Motorola	TACS	1994
Shanxi			
Taiyuan	Motorola	TACS	1991
Changzhi	Motorola	TACS	1992
Datong	Motorola	TACS	1992
Jingcheng	Motorola	TACS	1992
Linfen	Motorola	TACS	1992
Shuozhou	Motorola	TACS	1992
Jinzhong	Motorola	TACS	1994
Sichuan			
Chengdu	Ericsson	TACS	1990
Chengdu	Motorola	TACS	1993
Chongqing	Ericsson	TACS	1991
Chongqing	Motorola	TACS	1993
Deyang	Ericsson	TACS	1993
Deyang	Motorola	TACS	1993
Daxian	Motorola	TACS	1993
Fuling	Motorola	TACS	1993
Guanguan	Motorola	TACS	1993
Leshan	Motorola	TACS	1993
Luzhou	Motorola	TACS	1993
mianyang	Motorola	TACS	1993
Nanchong	Motorola	TACS	1993

Province	Supplier	Technology	Opened
Sichuan			
Nejiang	Motorola	TACS	1993
Panzhihua	Motorola	TACS	1993
Wanxian	Motorola	TACS	1993
Yibin	Motorola	TACS	1993
Zigong	Motorola	TACS	1993
Gas field:			
* Chongqing	NovAtel	450MHz	1989
Tibet (Xizang)			
Lhasa	Motorola	TACS	1992
Xinjiang			
Urumqi	Motorola	TACS	1993
Urumqi	AT&T	AMPS	1993
Shihezi	AT&T	AMPS	1993
Yunnan			
Kunming	AT&T	AMPS	1993
Kunming	Motorola	TACS	1993
Yuxi	Motorola	TACS	1993
Zhejiang			
Hangzhou	Motorola	TACS	1992
Hangzhou	Ericsson	TACS	1994
Jiaxing	Motorola	TACS	1992
Jiaxing	Alcatel	GSM	1992
Ningbo	Motorola	TACS	1992
Ningbo	Ericsson	TACS	1994
Shaoxing	Motorola	TACS	1992
Shaoxing	Ericsson	TACS	1994
Wenzhou	Motorola	TACS	1992
Wenzhou	Ericsson	TACS	1994
Huzhou	Motorola	TACS	1993
Jinghua	Motorola	TACS	1993
Lishui	Motorola	TACS	1993
Quzhou	Motorola	TACS	1993
Taizhou	Motorola	TACS	1993
Zhoushan	Motorola	TACS	1993
Juzhou	Motorola	TACS	1994

EXHIBIT 2

SYSTEM SUMMARY TABLE - CHINA UNICOM

Province	Supplier	Technology	Opened
Beijing	Siemens	GSM	1995
Guangdong Guangzhou	Motorola	GSM	1995
Shanghai	Siemens	GSM	1995
Tianjin	Siemens	GSM	1995

EXHIBIT 3

SYSTEM SUMMARY TABLE - CESEC

Province	Supplier	Technology	Opened
Guangdong			
Guangzhou	Nortel	AMPS	1993
Shenzhen	Nortel	AMPS	1994
Guangxi Beihai	Ericsson	AMPS	1994
Hainan Kaikou	Motorola	AMPS	1994
Hebei Shijiazhuang	Motorola	AMPS	1994
Heilongjiang Daqing	Hughes	E-TDMA	1995?
Hubei Wuhan	Nortel	AMPS	1994
Jiangsu Nanjing	Ericsson	AMPS	1994
Shandong Jinan	AT&T	AMPS	1994
Sichuan			
Chengdu	Hughes	E-TDMA	1994
Chengdu	Nortel	AMPS	1994
Zhejiang Hangzhou	Motorola	AMPS	1994

EXHIBIT 4

SYSTEM SUMMARY TABLE - HONG KONG

Operator	Supplier	Technology	Opened
Pacific Link	Ericsson	I-ETACS	1989
Pacific Link	Ericsson	TDMA	1993
HongKong Telecom-CSL	NEC	TACS-A	1987
Hongkong Telecom-CSL	Nokia	GSM	1993
Hutchison Telephone	?	TACS-B	1989
Hutichison Telephone	?	AMPS	1986
Smartone	?	GSM	1993

EXHIBIT 5

BEIJING SUBSCRIBER GROWTH

Year end	In year growth	Cumulative Subscriber
1987	-	-
1988	800	800
1989	800	1,600
1990	2,515	4,115
1991	3,475	7,590
1992	3,742	11,332
1993	19,468	30,800
1994	56,200	87,000 *
1995	60,000	147,000 *

* Forecast

EXHIBIT 6

SHANGHAI SUBSCRIBER GROWTH

Quarter	Growth	Cumulative Subscriber
Jun-94	-	55,000
Sep-94	10,000	65,000
Dec-94	10,000	75,000 *
Dec-95	45,000	120,000 * #

* Forecast
# 110,000 TACS and 10,000 GSM

EXHIBIT 7

GUANGDONG SUBSCRIBER GROWTH

Year end	Growth	Cumulative Subscriber
1987	0	0
1988	4,000	4,000
1989	4,000	8,000
1990	7,000	15,000
1991	15,000	30,000
1992	55,000	85,000
1993	135,000	220,000
1994	312,000	532,000 *
1995	248,000	780,000 *
1996	170,000	950,000 *
2000	550,000 to 1,050,000	1,500,000 to 2,000,000 *

* Forecast

EXHIBIT 8

CELLULAR SUBSCRIBER GROWTH IN CHINA

Year	In year growth	Cumulative Subscriber
1987	-	-
1988	6,000	6,000
1989	6,000	12,000
1990	10,000	22,000
1991	25,000	47,000
1992 (Jun)	35,000	82,000
1992 (Dec)	93,000	175,000
1993 (Jun)	184,000	359,000
1993 (Dec)	279,000	638,000
1994 (Jul)	422,000	1,060,000
1994 (Sep)	140,000	1,200,000
1994 (Dec)	400,000	1,600,000 *
1995	1,400,000	3,000,000 *
1996	1,500,000	4,500,000 *
1997	1,500,000	6,000,000 *
1998	1,500,000	7,500,000 *
1999	1,500,000	9,000,000 *
2000	1,500,000	10,500,000 *

* Forecast

EXHIBIT 9

ESTIMATED COMBINED PROVINCIAL TACS/AMPS SUBSCRIBER TOTALS FOR YEAR END 1993 AND 1994

Province	Subscribers End Dec 1993	Subscribers End Dec 1994
Anhui	11,500	24,000
Beijing	30,800	87,000
Fujian	32,600	71,000
Gansu	4,300	10,000
Guangdong	220,000	532,000
Guangxi	9,700	33,000
Guizhou	4,200	14,000
Hainan	11,300	25,000
Hebei	10,200	24,000
Heilongjiang	22,800	48,000
Henan	15,500	43,000
Hubei	16,700	44,000
Hunan	9,200	25,000
Inner Mongolia	3,400	9,000
Jiangsu	24,700	97,000
Jiangxi	7,800	19,000
Jilin	12,700	35,000
Liaoning	18,800	55,000
Ningxia	800	3,000
Qinghai	400	3,000
Shaanxi	16,000	28,000
Shangdong	28,500	69,000
Shanghai	52,800	96,000
Shanxi	8,600	18,000
Sichuan	11,900	51,000
Tianjin	15,500	26,000
Xinjiang	4,700	11,000
Xizang	600	1,000
Yunnan	8,400	21,000
Zhejiang	32,600	7,900
Total subscribers	638,000	1,600,000

EXHIBIT 10

CUMULATIVE SUBSCRIBER FORECAST

Technology	End93	End 94	End 95	End 96	End 97	End 98	End 99
TACS	638,000	1,548,600	2,485,500	3,417,900	4,348,800	5,279,400	6,210,000
GSM	0	300	299,700	1,130,000	1,990,500	2,852,600	3,714,200
CDMA	0	0	0	149,700	372,500	595,000	826,400
(D)AMPS	30,000	70,000	110,000	150,000	190,000	230,000	270,000
Total	668,000	1,618,900	2,895,200	4,847,600	6,901,800	8,957,000	11,020,600
Penetration	0.57	1.37	2.45	4.11	5.85	7.59	9.34

EXHIBIT 11

IN YEAR SUBSCRIBER GAIN FORECAST

Technology	End 94	End 95	End 96	End 97	End 98	End 99
TACS	910,600	936,900	932,400	930,900	930,600	930,600
GSM	300	299,400	830,300	860,500	862,100	861,600
CDMA	0	0	149,700	222,800	222,500	231,400
(D)AMPS	40,000	40,000	40,000	40,000	40,000	40,000
Total	950,900	1,276,300	1,952,400	2,054,200	2,055,200	2,063,600

EXHIBIT 12

CELLULAR SUBSCRIBER GROWTH IN HONG KONG

Year	In year growth	Cumulative Subscriber
1985	2,000	2,000
1986	3,000	5,000
1987	15,000	20,000
1988	20,000	40,000
1989	40,000	80,000
1990	45,000	125,000
1991	40,000	165,000
1992	48,500	213,500
1993	47,000	260,500
1994	104,500	365,000 *
1995	135,000	500,000 *
1996	300,000	800,000 *
1997	350,000	1,150,000 *

* Forecast

EXHIBIT 13

GUANGDONG PTA APPROVED TARIFFS

Tariff	RMB Yuan
Registration fee	200
Network connection	5,000
Monthly subscription	150
Annual Frequency charge	70
Value added services: call transfer, conferencing and call waiting - per month	10
Airtime charges:	
* local within city calls per minute	0.60
* Long distance per minute plus fixed network long distance charges	0.60
* IDD per minute plus fixed network international call charg	0.60
* Roaming in Guangdong per minute	1.20

EXHIBIT 14

BEIJING TELECOMMUNICATIONS ADMINISTRATION TARIFFS

Tariff	RMB Yuan
Registration fee	200
Network connection	5,000
Monthly subscription	150
Value added services: call transfer, conferencing and call waiting - per month	10
Airtime charges:	
* local within city calls per minute	0.50
* Long distance per minute plus fixed network long distance charges	0.50

EXHIBIT 15

SHANGHAI PTA APPROVED TARIFFS

Tariff	RMB Yuan
Registration fee	200
Network connection	5,000
Monthly subscription	50
Annual Frequency charge	100
Value added services: call transfer, conferencing and call waiting - per month	N/A
Airtime charges:	
* local within city calls per minute	0.50
* Long distance per minute plus fixed network long distance charges	0.50
* IDD per minute plus fixed network international call charg	0.50
* Roaming to other provinces per min plus fixed network long distance charges	1.00

EXHIBIT 16

ERICSSON TACS SYSTEMS FOR MPT IN CHINA

Province	MTX	Cell Sites	Radio Channels	Subscriber Capacity	Openned
Beijing	2	46	2,616	67,360	1,990
Shanghai	2	68	3,538	86,400	1,989
Tianjin	1	16	971	24,513	1,990
Guangdong	25	613	33,934	888,400	1,987
Guangxi	10	103	3,240	79,950	1,992
Hainan	2	32	1,204	31,053	1,992
Hebei	11	138	3,418	83,443	1,987
Heilongjiang	1	24	640	13,963	1,994
Hunan	12	158	5,381	128,000	1,992
Inner Mongolia	5	22	520	12,800	1,991
Jiangsu	2	31	350	6,767	1,993
Liaoning	14	98	2,954	76,550	1,994
Qinghai	1	2	48	12,432	1,993
Sichuan	3	76	2,602	58,987	1,990
Zhejiang	4	45	1,289	30,940	1,994
Total	95	1,472	62,705	1,601,558	

EXHIBIT 17

COMPARISONS OF ANALOGUE CELLULAR TERMINALS

Description	Nokia 101	Nokia 102	Sony CM-H333	NEC P1000	Toyocom HT9000	Motorola 8800X	Motorola 9900	Ericsson EH237
System	TACS/AMPS	TACS/AMPS	ETACS	TACS/AMPS	ETACS	TACS	TACS	TACS
Weight	275g	275g	235g	340g	190g	468g	218g	200g
Size (mm)	170x57x22/25	170x57x22/25	150x40x33.5	165x56x30	110x53x20	195x44x42	152x64x25	130x47x22
Volume (cc)	213	213	201	277	117	360	245	134
Battery Type	NiCd/NiMH	NiCd/NiMH	NiCd	NiCd	NiCd	NiCd	NiCd	NiCd
Talk Time								
Slim battery	-	-	-	-	40	66	45	-
Standard battery	50	50	90	100	80	132	65	70
High capacity battery	100	100	-	180	110	264	120	140
Memory	50	50	9	24	80	99	99	199

EXHIBIT 18

COMPARISONS OF DIGITAL CELLULAR TERMINALS

	Smartone 902	SmarTone 802	SmarTone 808	Nokia 2112	Ericsson GH337
Weight (with standard battery)	461g	285g	238g	236g	220g
Talking/standby (up to)					
Slim battery	-	1/12 *	1/11	-	1.5/18 *
Standard battery	1.67/15	1/12	1.58/18	1/18 *	1.83/18 *
Extended battery	3.5/30	2.5/24 *	2/23	3/50 *	3.17/35 *
Phone Number Memory	130	130	130	155	+30
Dialled Calls Memory	1	1	10	10	10
Notepad Memory	Y	Y	Y	Y	Y
One-touch dialling	-	-	9	9	-
Auto Redial	Y	Y	Y	Y	Y
Mute control	Y	Y	Y	Y	Y
Signal Strength Indicator	Y	Y	Y	Y	Y
Battery Meter	Y	Y	Y	Y	Y
LCD Display Capacity	2 x 8	2 x 12	2 x 12	3 x 10	3 x 12
Status Indicator Light	-	-	-	Y	Y
Clock, Alarm function	-	-	-	-	Y
Short Message Capability	Y	Y	Y	Y	Y
Call Timer	Y	Y	Y	Y	Y
Low Battery Alarm	Y	Y	Y	Y	Y
Any Key Answer	Y	Y	Y	Y	-
Battery Saving Operation	Y	Y	Y	Y	Y
Silent Service	Y	Y	Y	Y	Y
Electronic Lock	Y	Y	Y	Y	Y
IDD Lock	Y	Y	Y	Y	Y
Noise Cancelling Microphone	Y	Y	Y	-	-
Hi-Fi Performance Earphone	-	-	-	-	Y
Ringing Tone Selection	-	-	13	5	4
Automatic Discharge Function	-	-	-	-	Y
Earphone Option	-	-	-	-	Y
Data Transmission Capability	-	-	Y	Y	Y
Language Selection	12	12	14	10	11
DTMF Signalling	Y	Y	Y	Y	Y
Vibration Alert	-	-	Y	-	-
Internal/Travel Charger	Option	-	Y	Y	Option
Type of SIM Card	Plug-in	Full size	Full size	Plug-in	Plug-in

Y = Yes

* = Those with this mark are NiMH batteries, others are NiCd batteries

EXHIBIT 19
CHINA MARKET SHARES BY BRAND

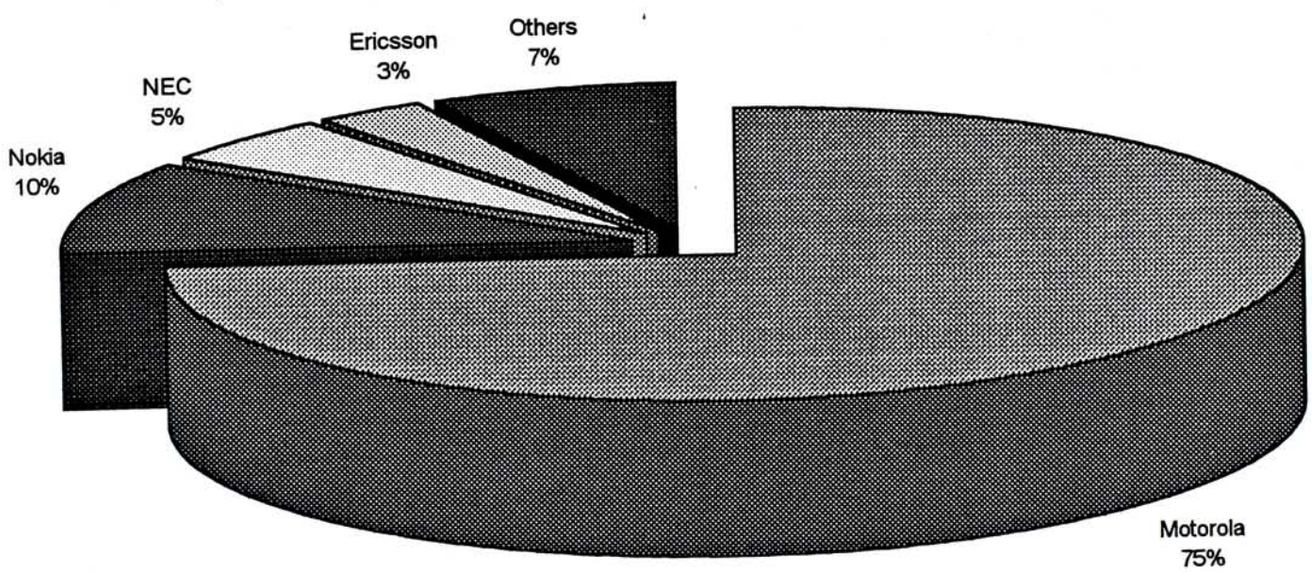


EXHIBIT 20
CELLULAR TERMINALS CUMULATIVE
MARKET SHARES BY MANUFACTURER

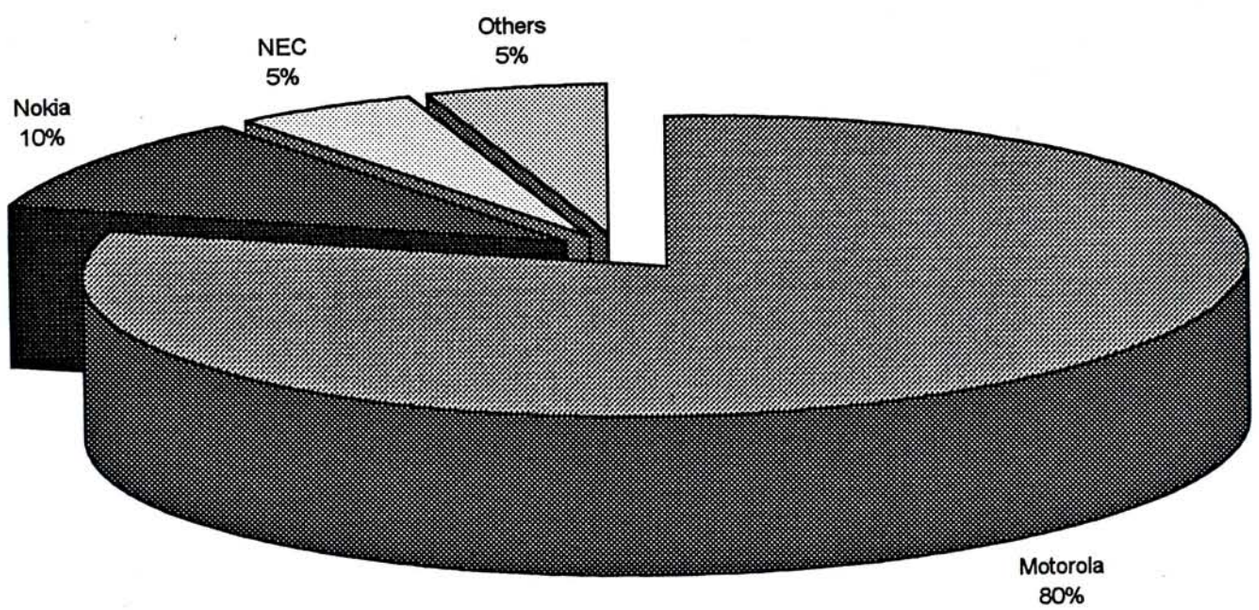
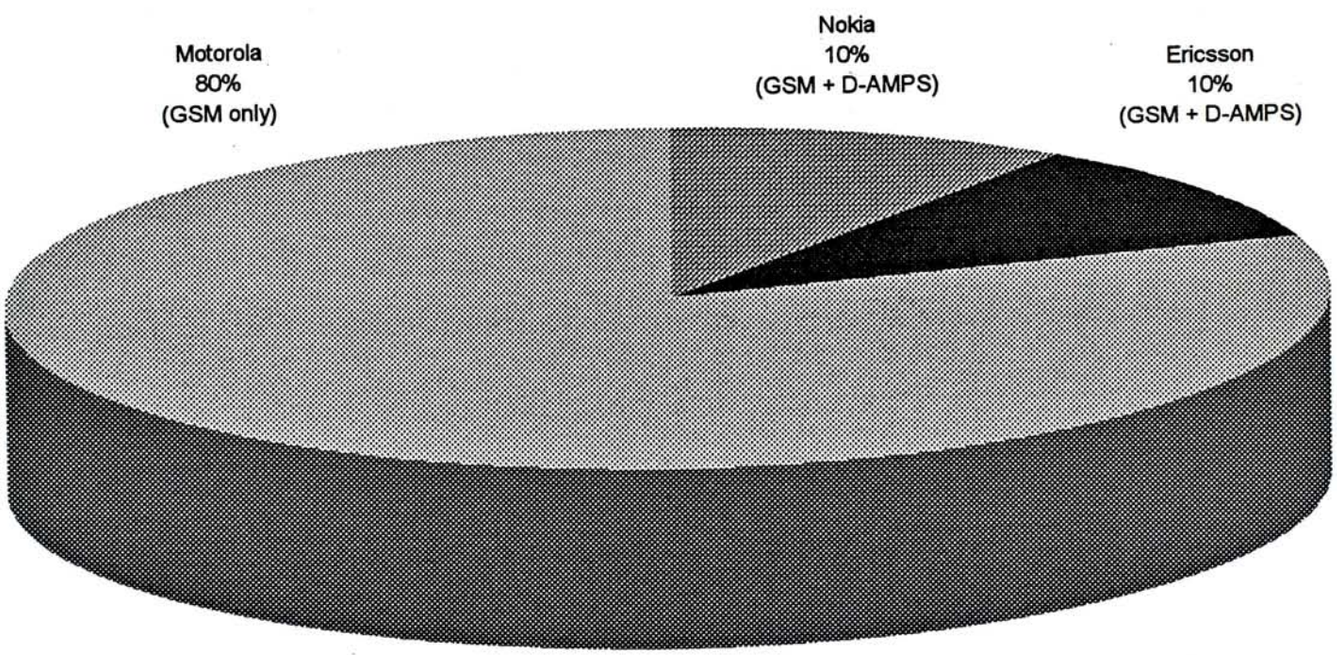


EXHIBIT 21
ESTIMATED DIGITAL MARKET SHARES BY MANUFACTURER



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